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Research article

Predictors of landscape preferences in large hotel complex tourism

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ABSTRACT

This study analyses the landscape preferences of large hotel complex tourism in Cuba using an approach based on the classic Kaplan (1989) matrix, expanding it with two complementary variables ("Sense of Being Away" and "Aesthetic Appeal"). The objectives of the study include, firstly, verifying whether the variables of the proposed model are valid determinants of landscape preferences. Secondly, studying the relationships between these variables and the Construction Intensity (associated with the different types of hotel complexes). And finally, to determine the ideal set of factors to predict landscape preferences. To this end, undergraduate and postgraduate students in Spain and Brazil were surveyed regarding their landscape preferences using photographs of landscapes with and without tourist constructions. The results indicate that Aesthetic Appeal is the variable that correlates best with General Preference, followed by Mystery and Harmony, while Diversity shows the weakest correlation. Another relevant finding is that the behaviour of the six variables of the "extended Kaplan" model is affected by Construction Intensity, with the models that include this variable having the greatest explanatory power. Finally, the model with the highest predictive ability for General Preference combines Harmony, Aesthetic Appeal and Mystery. The results support the strength of the proposed "extended Kaplan" model and the relative importance of considering Construction Intensity in landscape preference analyses. It is perceived that there is a need for enhanced landscape integration of tourism developments to unite customer satisfaction with landscape conservation.

1. Introduction

The latest data on international arrivals suggest that the tourism sector will have recovered to, or even surpassed, pre-COVID19 pandemic levels by the end of 2025 [1]. Despite economic and geopolitical instabilities, tourism is expected to remain one of the fastest growing economic activities in the coming years. While the economic [2] and social [3,4] impacts of this sector are mostly positive, the relationship with the environment remains unclear, as without proper management it can contribute to the deterioration of the environment [5] and the landscape [6], especially in non-urban tourism modes. This may result in a loss of the main resource that feeds tourism activity, high quality landscapes [7] with the risk that this entails of a decrease in tourist activity and the economic

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development of some territories [8,9].

The study of the relationship between tourism activity and its environmental and landscape settings is crucial for the sector. Especially in categories such as “sun and sand” large hotel complexes (or “all-inclusive” resorts), characterised by extensive occupation and the transformation of the territory in areas that were fairly intact [10–12]. This is the case in our study area in: Cayo Santa María in Cuba. This small island constitutes a paradigmatic example of accelerated tourism development, which can be extended to many other regions of the planet sharing similar characteristics where this mode of tourism is expected to grow notably in the coming years [13,14].

The European Landscape Convention [15] stresses the relevance of the landscape preferences of the population to complement the criteria of experts [16]. Thus, it is essential to promote sustainable tourism development and land management strategies that incorporate a landscape perspective [17]. The combination of both approaches (technicians and citizens) has been shown to be effective in improving spatial planning [18].

One of the main objectives of research on landscape perception is to determine the factors that affect individual preferences [19]. In this line of research, two main currents can be highlighted: *evolutionary* theories and *cultural preference* theories. One of the best-known approaches within the first group is the model developed by Kaplan and collaborators [20,21], according to which, preference is dependent on four *structural* properties (specific to the environment under study): *coherence* and *complexity* (at the immediate level) and *legibility* and *mystery* (at the inferred level). Among the keys to the success of Kaplan’s informational model are its simplicity, consistency, adaptability and explanatory nature in different contexts. However, meta-analyses indicate that the correlation between Kaplan’s four factors and overall preference for a landscape yields heterogeneous results (*Coherence* and *Mystery* being the best predictors). They also vary according to the landscape studied, which can be accentuated when comparing "natural" with "constructed" environments [22], with this contrast being one of the objectives of this study.

This informational perspective is of particular interest to tourism as it points to the fact that in its evolution, humans have adapted to explore and understand landscapes by seeking a balance between novelty and familiarity [23], which is common in tourism. Although studies on "virtual tours" point to the usefulness of the Kaplan model for predicting visitor satisfaction and subsequent "loyalty" [24], it has been little applied in the tourism sector [25–28] and so far has not been applied to the planning of new tourism developments, which is one of the main objectives of this paper.

Other proposals of interest in the context of tourism are, firstly, the Attention Restoration Theory (ART) [21], which studies the components that a "restorative environment" should include to reduce stress and promote recovery from mental fatigue, placing an emphasis on four factors: Being Away ("Getting away from it all"), Extent (rich in elements and coherence), Fascination and Compatibility. Secondly, the Perceived Restorative Potential (PRP) concept [29] analyses how the individual perceives that the environment affects his or her state (recovery, relaxation, etc.). This concept is related to the Perceived Restorativeness Scale (PRS) [30], similar in structure to the previous one, with four components: Being Away, Fascination, Compatibility, Coherence. It is worth noting that, in these two scales (ART, PRS), only the Being Away component represents a real novelty with respect to Kaplan’s classical model, since Extent includes Complexity and Coherence; while Fascination and Compatibility can be considered equivalent to Mystery and Legibility, respectively.

Finally, it is worth adding the importance of aesthetic appreciation and valuation, given that different studies in environmental psychology have shown their close association with the two fundamental dimensions of meaning (pleasure and arousal) that individuals find in their physical environment [31]. This aesthetic appreciation promotes psychophysical well-being [32,33] and increases the tourism potential of a destination [34].

This paper is the second part of a larger study, which analysed the landscape preferences of potential customers of large hotel complexes in the north of Cuba, according to different variables. These variables included academic background and construction intensity associated with tourism development, as well as the socio-demographic profile of the respondents [35]. Here, the four classic variables of Kaplan & Kaplan’s [21] informational model, along with two additional variables ("Sense of Being Away" and "Aesthetic Appeal") will be incorporated into the analysis.

The study therefore has three objectives: (i) to assess whether the variables of the proposed model *(extended Kaplan*) are valid determinants of landscape preferences in large complex tourism; (ii) to study the relationships between these potential determinants and Construction Intensity; and (iii) to determine the ideal set of factors to predict landscape preferences in this area. In order to achieve these objectives, the following hypotheses are established and tested: H1, the variables "Sense of being away" and "Aesthetic Appeal" improve the prediction performance of the classical Kaplan model of landscape preferences in the territorial and tourism context analysed; H2, Construction Intensity (illustrated by the different types of hotel complexes) modulates the behaviour of the variables of the model. The ultimate goal is to optimise tourism planning, seeking a balance between satisfying user preferences and the conservation and appropriate management of the landscape.

2. Materials and methods

2.1. Assessment of landscape preferences

This research is based on the assessment of individual landscape preferences, whose methods can be divided into direct and indirect ones [36], sometimes named differently depending on the author (i.e.: "public preference models" and "descriptive inventories methods" [37]). The former use a questionnaire to measure users’ preferences about landscapes, while the latter evaluate the landscape according to the presence and/or intensity of different components (vegetation, water bodies, buildings, etc.). In this paper, we have adopted an approach that combines both types of methods (the so-called "Holistic models").

The assessment of landscape preferences through photographs-based surveys has been widely used in landscape studies [38–40], including coastal areas [41,42]. Several studies have confirmed its suitability and the high similarity between the responses to photographs and those given *in situ* [43–45].

Previous studies on Cayo Santa María defined a methodology to diagnose the change in landscape quality through an expert-based approach [46] based on the classification and characterisation of types of hotel complex [47] (Fig. 1) (Annex I). Subsequently, this diagnosis was compared against the so-called "direct methods" by means of questionnaires to potential tourists in which they had to show their landscape preferences by looking at photographs of landscapes with and without constructions associated with tourism development [35].

2.2. Preparation of the questionnaire

To perform the assessment of the landscape units by potential tourists, an online questionnaire was developed aimed at undergraduate and postgraduate students from Spain and Brazil. The questionnaire contained 20 photographs of different landscape units in the study area, half of which included buildings associated with tourism development, while the other half corresponded to the same (or equivalent) units but without buildings (Annex II).

The photographs were selected in pairs, in such a way that each pair of pictures (the same unit with and without buildings) was homogeneous in terms of composition (percentage of land, sea, sky, vegetation, etc.). The perspective and orientation from which the photograph was taken was kept consistent across each image pair, so that the only truly differentiating element was the building associated with the tourism development. Representations of the four main types of manmade units associated with tourism development were selected (Annex III).

For each image, respondents were first asked to express their overall rating, or "General Preference" (hereinafter, GP) [31] using a Likert scale on which 1 was the minimum value ("I don't like it at all") and 5 was the maximum value ("I like it a lot"). The direct GP measurement by means of the questionnaire was complemented by the indirect measurement of landscape components ("surrogate component techniques"), with an important caveat. In this case, it was not necessary to measure all landscape components, as in previous studies in this line [48]. This is because, given the high similarity of the components and the perspective in the images, the only real difference between the pairs of photographs were the buildings associated with tourism development. This variable was referred to as "Construction Intensity" (hereinafter CI) [35] and is based on the classification proposed by Ref. [47] for large hotel complexes, a summary of which appears in Annex I. The main criteria used to classify the different types of anthropic units (with four levels of Construction Intensity) were the plot or pattern of land occupation, the percentage of native vegetation maintained within the complex and, with respect to the buildings: the general appearance, size, height, shapes, colours and materials used in their construction.

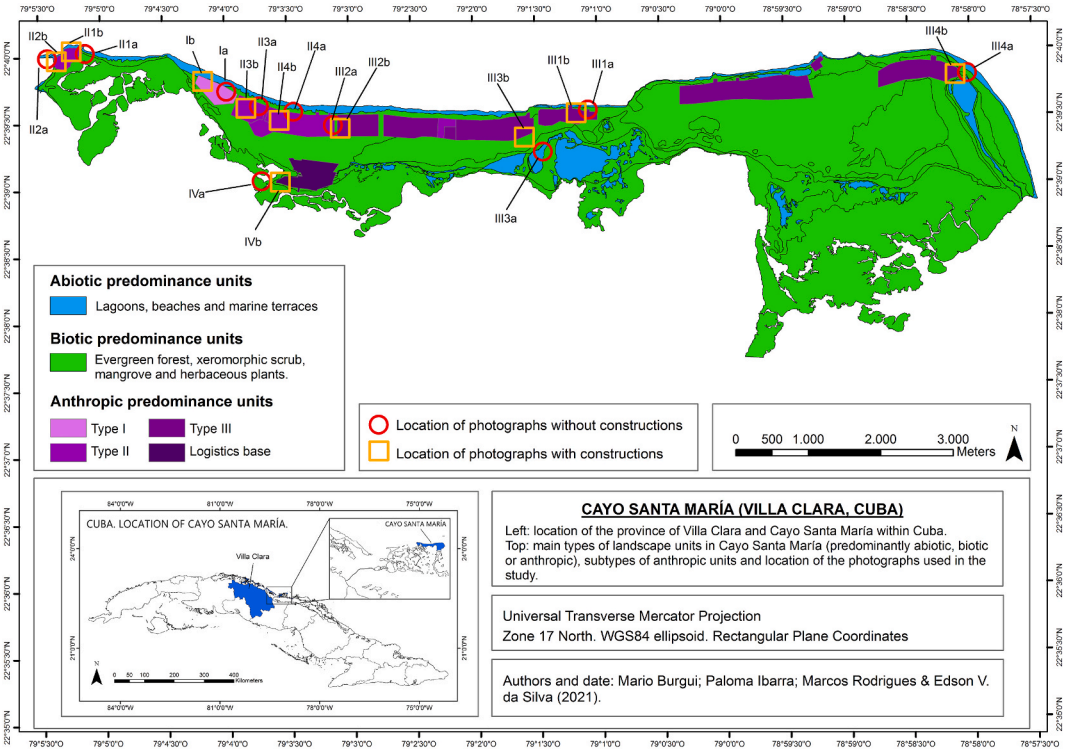

Fig. 1. Location map of the landscape units photographed. Author compilation.

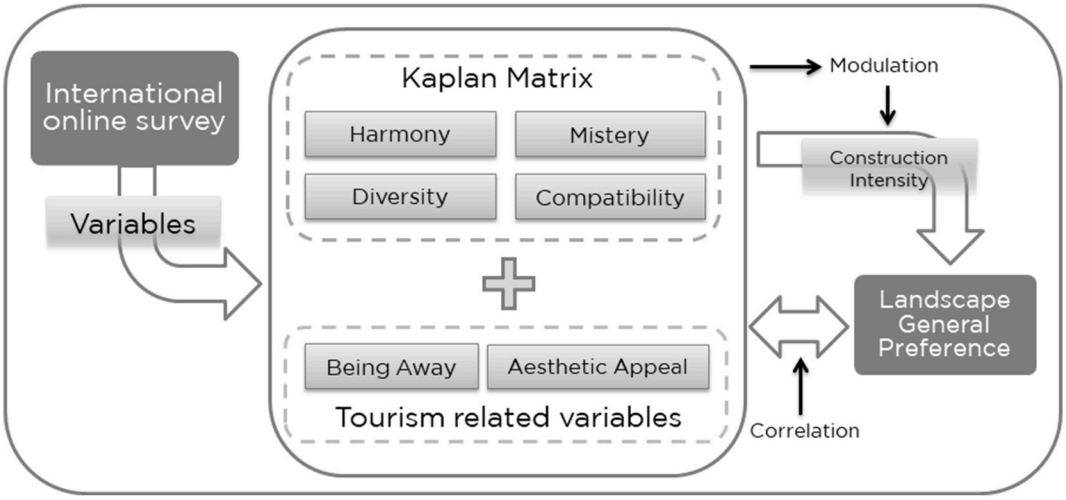

Fig. 2. Variables included in the analysis. Source: The authors.

A review of the literature confirmed the widespread use of the Kaplan model in recent decades, often adapted to suit the purposes of the study [22]. Often, the new variables incorporated in some studies can be grouped into one of the four original properties and the model may even be equivalent to other non-informational ones (Annex V). In our analysis, Kaplan's original four variables were used, with the addition of *Aesthetic Appeal* and *Sense of being away* (see Fig. 2).

Therefore, in the second part of the questionnaire, respondents were required to indicate their degree of agreement (Likert scale 1–5) with 6 statements referring to each image, although in this case, aimed at assessing the six variables mentioned above. Short statements were chosen so that they could be viewed on mobile devices and to minimise participant fatigue (Table 1) For a more detailed description of the sample design, as well as the design and implementation of the questionnaire, see Ref. [35].

2.3. Data processing

A total of 780 responses were obtained, evenly distributed across countries, age group and gender ratio in line with the usual demographics of university students. Having cleaned the data (invalid or erroneous responses), the final sample consisted of 712 responses (Table 2).

2.4. Statistical analysis

First, the original scores were taken to calculate the correlation between each variable and the General Preference (GP) for photographs with and without constructed elements. To simulate the existence of multiple samples in the survey population, 100 random samples with 50 % of the observations were drawn proportionally to the total number of observations by gender, age, country and subject area. For each sample, the Spearman's Rho coefficient was calculated by aggregating the 100 values obtained as the arithmetic mean and its standard deviation. This analysis was repeated for the photographs with buildings, calculating the correlation between the 6 variables and GP as a function of building intensity.

Secondly, to generate an explanatory model with the variables or factors that best explain the GP, ordinal regression models [49] were adapted to each variable, as well as to an optimised selection of variables that met the requirements demanded by the ordinal model. Each model was used to predict GP, comparing the predicted value with the given score using Spearman's Rho correlation coefficient. This made it possible to assess the degree to which each model was able to explain GP. In addition, the models were compared using ANOVA to determine the extent to which the models are different from one another. Through this procedure, it is possible to determine which variables are most strongly related to GP. All analyses were carried out using R (Version 4.4.0) [50].

3. Results

The variable showing the strongest association with General Preference is Aesthetic Appeal (Rho = 0.668/0.643), with a 0.05 higher correlation than the other closest variables. The variable that correlates worst is Diversity (Rho = 0.323/0.282). In general, higher correlation can be seen in photographs without built elements, returning a higher difference in Diversity, with a 0.04 higher

Table 1
Variables studied and their corresponding statements in the questionnaire. Author compilation.

Factors	Statements
Coherence/Harmony	"The parts form a harmonious whole".
Variety/Diversity/Complexity	"There are many different elements".
Compatibility/Legibility	"I could do things I like to do here"
Fascination/Mystery	"I would like to explore/tour this place"
Being away	"Ideal for being away from my routine"
Aesthetic Appeal	"I think it's a beautiful place"

Table 2
Frequency distribution of responses by country, gender, age and field of knowledge. Author compilation.

	Count	%
COUNTRY		
Spain	333	46.77
Brazil	379	53.23
GENDER		
Male	313	43.96
Female	399	56.04
AGE		
<18	6	0.84
18–34	606	85.11
35–50	100	14.05

correlation in photographs without buildings (Table 3, Fig. 3).

Focussing the analysis on the photographs with buildings as a function of Construction Intensity, an increase in the strength of correlation is observed as CI increases for all variables except Diversity (Table 4). As expected, a decreasing value in average ratings (Var_avg) and GP (GP_avg) is observed as CI increases. Again, Diversity is the only exception to this behaviour, with a rating of 3.98 to 3.56, which remains virtually the same. Furthermore, there is a noticeable difference between the correlation obtained for Type I Complexes (Bungalows) and the others (Types II, III and IV). In all cases, the scores (of both GP and the 6 variables) are higher for Type I Complexes than for the other three types of man-made units. There seems to be some degree of consensus among respondents on the worst assessment of Complexes II, III and IV.

3.1. Explanatory models of General Preference

Similar to the correlation analysis, Aesthetic Appeal is the variable that best explains General Preference (Rho = 0.631), with Diversity being the least correlated. Construction Intensity has some impact, increasing the explanatory capacity of all univariate models, although to a lesser degree in terms of Harmony. The effect of CI is particularly strong in Diversity. The best combination of variables combines Harmony, Aesthetic Appeal and Mystery. This combination satisfies the requirement of independence of the explanatory factors (VIF <4; not reported), maximising the explanatory power, which increases slightly with respect to the model combining Aesthetic Appeal and CI (Rho = 0.667 and 0.631 respectively). It is worth noting that the combined model does not improve with the inclusion of CI, possibly due to the inclusion of Harmony, which shows little sensitivity to CI (see Table 5).

Table 3
Summary of the correlation analysis between the surveyed variables and the GP. Construction: presence/absence of constructions in scores; Rho_avg: average value of Spearman's correlation coefficient; Rho_sd: standard deviation in the correlation coefficient (n = 100). Author compilation.

Variable	Construction	Rho_avg	Rho_sd
Harmony	no	0.586	0.007
	yes	0.615	0.010
Compatibility	no	0.606	0.007
	yes	0.574	0.009
Diversity	no	0.323	0.013
	yes	0.282	0.012
Mystery	no	0.613	0.008
	yes	0.599	0.009
Being Away	no	0.604	0.009
	yes	0.600	0.009
Aesthetic Appeal	no	0.668	0.008
	yes	0.643	0.008

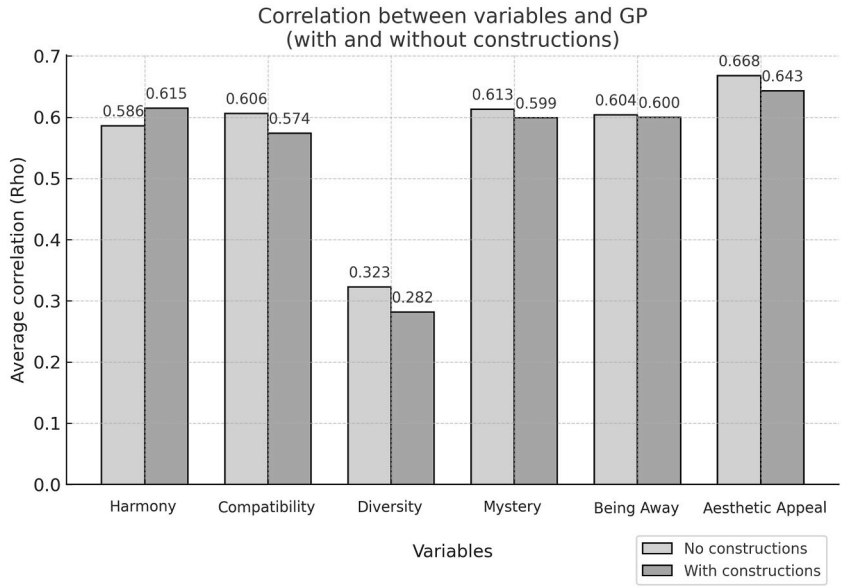

Fig. 3. Summary of the correlation analysis between the surveyed variables and the GP (n = 100). Author compilation.

Table 4
Summary of the correlation analysis between the surveyed variables and the General Preference in terms of Construction Intensity. CI: levels of Construction Intensity in scores; Rho_avg: average value of Spearman's correlation coefficient; Var_avg: average score of the variable surveyed; GP_avg: average score of the GP. Author compilation.

Variable	CI	Rho_avg	Var_Avg	GP_avg
Harmony	I	0.441	3.94	3.91
	II	0.563	3.50	3.44
	III	0.552	2.74	2.81
	IV	0.590	2.14	2.34
Compatibility	I	0.406	4.10	3.91
	II	0.521	3.76	3.44
	III	0.521	3.18	2.81
	IV	0.536	2.50	2.34
Diversity	I	0.289	3.98	3.91
	II	0.300	3.62	3.44
	III	0.267	3.54	2.81
	IV	0.173	3.56	2.34
Mystery	I	0.474	4.24	3.91
	II	0.555	3.85	3.44
	III	0.542	3.24	2.81
	IV	0.517	2.66	2.34
Being Away	I	0.428	4.25	3.91
	II	0.540	3.90	3.44
	III	0.536	3.17	2.81
	IV	0.556	2.40	2.34
Aesthetic Appeal	I	0.493	4.23	3.91
	II	0.591	3.88	3.44
	III	0.590	3.15	2.81
	IV	0.563	2.52	2.34

A comparison of models using ANOVA (Table 6) identifies 2 groups of models: Harmony, Aesthetic Appeal and the combined model (H + A + M) (Group 0) versus the other models (Group 1). The deviation of the residuals would position the combined model as the best solution based on the criteria of minimising the deviation.

4. Discussion

The results obtained show, firstly, the strength of the proposed model, with a significant and positive correlation between the 6 variables and the GP, although with notable differences. The lower correlation value of the Diversity variable with the GP is worth noting here. Secondly, the two variables incorporated in this proposal to the classic Kaplan model attained similar if not stronger

Table 5
Validation using Spearman's Rho correlation coefficient of the ordinal regression models between the General Preference (response variable) and the variables analysed. Construction Intensity indicates whether this variable has been included (yes/no) as an explanatory factor. Author compilation.

Variable	Construction Intensity	
	No	*Yes*
Harmony (A) (H)	0.592	0.599
Compatibility (C)	0.550	0.580
Diversity (D)	0.277	0.415
Mystery (M)	0.577	0.605
Being Away (B)	0.579	0.595
Aesthetic Appeal (A)	0.618	**0.631**
H + A + M	**0.667**	0.665

Table 6
Results of model comparison using ANOVA. Author compilation.

Model	Residual Deviance	Pr(Chi)	Group
Harmony (H)	**18859.82**		
Compatibility (C)	19296.75	−436.931	1
Diversity (D)	20825.21	−1528.46	1
Mystery (M)	19043	−481.575	1
Being Away (B)	19164.41	−121.404	1
Aesthetic Appeal (A)	**18561.43**	2263.782	0
H + A + M	**17981.17**	1183.238	0

association with GP. This result is particularly interesting considering that Aesthetic Appeal and Being Away in a beautiful and different place are among the main motivations for tourists to choose a recreational destination [51–53]. On the other hand, it is worth putting into context the fact that Aesthetic Appeal is the variable that is most associated with GP, given that this is a variable that was not included in other scales such as ART or PRS. This indicates the desirability of including the aesthetic factor in the models as a possible predictor of landscape preferences in this type of tourism, which aligns with prior research emphasising the importance of aesthetic quality [54], especially in coastal areas such as those studied [55].

The overall results mentioned above are observed irrespective of the presence/absence of constructed elements and also irrespective of the Construction Intensity in the images with buildings. Again, it is worth noting that for all variables except Diversity, the strength of the correlation with GP increases as the CI increases. Moreover, although this also occurs in images without constructions, it could be suggested that Diversity is particularly affected by CI: the higher the CI in the image, the lower the reliability of the Diversity component in predicting the GP (Rho = 0.173 in Type IV Complexes, compared to an average of Rho = 0.55 for the remaining variables) (Table 4).

Therefore, we can conclude that, in this case study, greater diversity of components does not imply greater GP. This behaviour seems to be due to the effect of CI. As CI increases, respondents continue to recognise a high Diversity value, which in our context implies increased presence of man-made components that exert greater contrast. However, this does not result in greater GP (as is often the case when the number of natural features increases), but rather the opposite. It is true that landmark studies already pointed to the limited predictive power of diversity/complexity [21], which may be because this factor is a good predictor particularly when it is in balance with Coherence and when it refers to the diversity of natural components [56]. However, meta-analyses conducted on articles published for over 30 years [22] did not find such a low correlation value between the Diversity variable and GP as the one in this study. Therefore, this could be a paradigmatic example of how the inclusion of anthropic components in the natural landscape worsens the predictive power of the diversity factor.

The tests conducted to determine the best series of variables for predicting GP postulate Aesthetic Appeal as the most suited variable, relegating Diversity to the worst alternative. One important point to note is that when the CI variable is included in the analysis as an explanatory factor, the predictive capacity of all univariate models improved without exception, which emphasises the importance of considering the effect of the buildings in analyses of landscape preferences for new tourism developments in similar areas. This result is in line with the usefulness of combining different domains of predictors pointed out by Kaplan & Kaplan [21], given that the CI belongs to the "Physical Attributes" type of predictors, while the 4-variable matrix would fall into the "Informational" category. The theoretical and practical importance of these results lies in the identification of a key variable (CI) within the group of physical attributes characterized by Kaplan, which can modulate landscape preferences in contexts such as the present one. With this,

it is possible to enhance the predictive potential of the classical informational matrix.

Nevertheless, it is also worth mentioning that, with respect to Harmony, the inclusion of the CI in the model hardly improves it. This could mean that - in this case study and with this type of landscape - the buildings included in the images do not integrate very harmoniously with the existing natural landscape, especially complexes type II, III and IV. This occurs when basic principles of nature-integrated design are not taken into account to reduce the contradictions between the artificially created architectural environment and the natural one [57]. Such argument is reinforced by the fact that respondents gradually rate complexes II, III and IV worse than type I complexes (with lower building intensity), which are more harmoniously integrated into the natural landscape, as expert assessments in previous studies showed [35]. Therefore, as demonstrated by other case studies in coastal areas, it is essential to carry out a rigorous landscape integration analysis prior to urban planning and architectural design of new tourism developments [58].

Regarding the best performing model (Harmony + Mystery + Aesthetic Appeal; Rho: 0.667), it should be noted that the first two variables already cover the four dimensions of Kaplan's information matrix: immediate + comprehensive (Harmony) and inferred + exploratory (Mystery). On the other hand, these results are consistent with the aforementioned meta-analyses on the Kaplan model, where both variables were found to be the best predictors of GP (Stamps, 2004) [22]. The presence of Harmony in the model and the absence of Diversity (which is its immediate counterpart) makes even more sense in relation to the previous results of our study: a greater diversity of components in a landscape does not necessarily produce a positive result if these components are not harmoniously integrated into the whole [56]. Thirdly, this model includes the aforementioned Aesthetic Appeal, an unusual variable in other scales related to the Kaplan model [20,21,29,30]. This variable is also present in the second model with the highest predictive power according to our analysis (A + CI; Rho: 0.631) and its significance, together with that of Harmony, was supported by the comparison of models using ANOVA.

Remarkably, the best suited model for predicting GP, which combines Aesthetic Appeal, Harmony and Mystery, attains the same performance irrespective of accounting for CI. This suggests that certain combinations of variables may intrinsically incorporate the perceived influence of constructions.

These results reinforce the idea that the assessment of aesthetic appreciation is essential to guide spatial planning and management [18,59,60]. For the tourism sector, in particular, it is key to consider this type of analysis, so that new development plans preserve the aesthetic beauty of the landscape [61,62], given the risk of losing visitors due to the loss of scenic recreational benefits [63].

Regarding the limitations of this research, sight should not be lost of the fact that any variable model is highly dependent on the sample used (in our case, both the respondents and the images being rated). Therefore, for future work it would be convenient to test the proposal of this study in different landscape, tourist or urban development contexts. In respect of the images themselves, including variations in the scenario (seasonal, meteorological, perspective …) could contribute to validate the model and confirm its robustness. On the other hand, broadening the sample spectrum to participants with different social and economic conditions could shed more light on the factors that determine landscape preferences. Finally, another line of work would be to compare the performance of this methodology with others, either based on saliency methods in photographic simulations of buildings [40], or with advanced machine learning/deep learning techniques in the prediction of perceptions [54].

5. Conclusions

This paper constitutes the second part of a study of landscape preferences for the tourism development of large hotel complexes in Cuba, using "public preference models" as a complement for the purposes of planning according to expert judgement.

The main objective was to assess the landscape preferences predictive potential of a series of variables constructed using the Kaplan information matrix in a territorial and tourism context where it had not been used to date. For the proposal of this "extended Kaplan" model, the scientific literature on the various factors that may be relevant in these areas, such as the Sense of Being Away and Aesthetic Appeal, was taken into account.

Based on the analyses undertaken, we can firstly highlight the strength of the proposed model to determine the General Preference of the landscapes subject to assessment, both in images with only natural components and in those with man-made elements with different degrees of Construction Intensity.

However, not all variables were equally reliable. Thus, Aesthetic Appeal scores were above average, while Diversity scores were notably lower. With regard to the former, they are consistent with previous studies that highlight their importance both in terms of the psychophysical well-being they promote for people (important in a tourism context) and in terms of their support for land-use planning and management. In contrast, Component Diversity did not correlate well with landscape preference in any type of landscape, although in this case, its predictive potential also appears to worsen as Construction Intensity increases in the image. This fact, combined with the results of the first part of this research [35], supports the thesis that there is a need for greater landscape integration of tourism development constructions in this type of ecologically and visually valuable yet fragile context. This will also help to better

meet visitors' expectations.

Secondly, the search for a model with the best combination resulted in a series of only three variables, which in addition to encompassing the four dimensions of Kaplan's original matrix, added Aesthetic Appeal. This suggests that it is possible to obtain equal or greater predictive capacity by means of simpler questionnaires.

The results support the notion that these variables, coupled with the construction intensity, should be taken into consideration in landscape preference analysis processes in these territorial contexts, so that the planning of new tourism developments combines the satisfaction of potential customers (and, ideally, of the population as a whole) with landscape protection.

Finally, in light of the results, greater efforts are needed in relation to environmental and landscape education, both for users and managers of tourism, as well as for territorial planners and the population in general. Reflection and caution should be encouraged in the transformations that humans perform in landscapes of particular aesthetic and ecological quality, which are increasingly threatened and subject to major uncertainties as we look to the future.

CRediT authorship contribution statement

Mario Burgui-Burgui: Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Paloma Ibarra-Benlloch:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Conceptualization. **Marcos Rodrigues:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Ethics and consent

Data collection for this work was carried out by obtaining implicit consent through the submission of a questionnaire.

The Research Ethics and Animal Experimentation Committee of the University of Alcalá evaluated the research project entitled "Influencia de los valores ambientales sobre las preferencias paisajísticas en el turismo de grandes villas hoteleras", of which this publication forms part.

Having analysed the points accredited in the dossier, the Committee considered that the research project and the procedure evaluated are correct from the ethical and methodological point of view, and therefore gave its approval for its FAVOURABLE report.

This report was signed in Alcalá de Henares, on 14 March 2024 by F. Javier de la Mata de la Mata, President of the REC and EA.

The code assigned to the favourable report is: CEIP/2024/2/016.

Advisory/management and consulting positions

•We, the authors and our immediate family members, have no positions to declare and are not members of the journal's advisory board.

Patents

•We, the authors and our immediate family members, have no related patent applications or registrations to declare.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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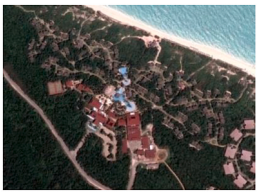
ANNEXES.

ANNEX I: Types of constructions defined in Cayo Santa María

Types of constructions defined in Cayo Santa María. Source: The authors.

Satellite images	Photographs	Main characteristics
Type I Resorts 		• Small bungalow-type cabins made of light materials (e.g. wood). • Low-rise (between 1 and 2 storeys). • Colours well integrated into the landscape. • Low building density in the resort as a whole. • Large amounts of vegetation between cabins (abundant autochthonous vegetation). • Low geometric regularity in the spatial layout of the constructions.
Type II Resorts 		• Medium-sized buildings made of moderately heavy materials. • Medium-rise (generally 2 storeys), • Colours poorly integrated into the landscape. • Resort with low-medium building density • Moderate amounts of vegetation between buildings (moderate amounts of autochthonous vegetation). • Moderate-high geometric regularity in the spatial layout.
Type III Resorts 		• Large buildings made with heavy materials. • Mostly 4 storeys high. • Colours poorly integrated or unintegrated into the landscape. • Medium-high building density in the resort as a whole. • Medium-low amounts of vegetation between buildings (moderate amounts of autochthonous vegetation). • Moderate-high geometric regularity in the spatial layout.
Logistics base 		• Large buildings made with heavy materials. • Medium-high rise (from 2 to 4 storeys). • Colours poorly integrated or unintegrated into the landscape. • Very high building density in the logistics area as a whole. • No vegetation. • High geometric regularity in the spatial layout.

Source of satellite images: Google Earth, 2021. Photographs by the authors.

ANNEX II: Photo pairs used in the questionnaire

Photo pairs used in the questionnaire. Source: The authors.

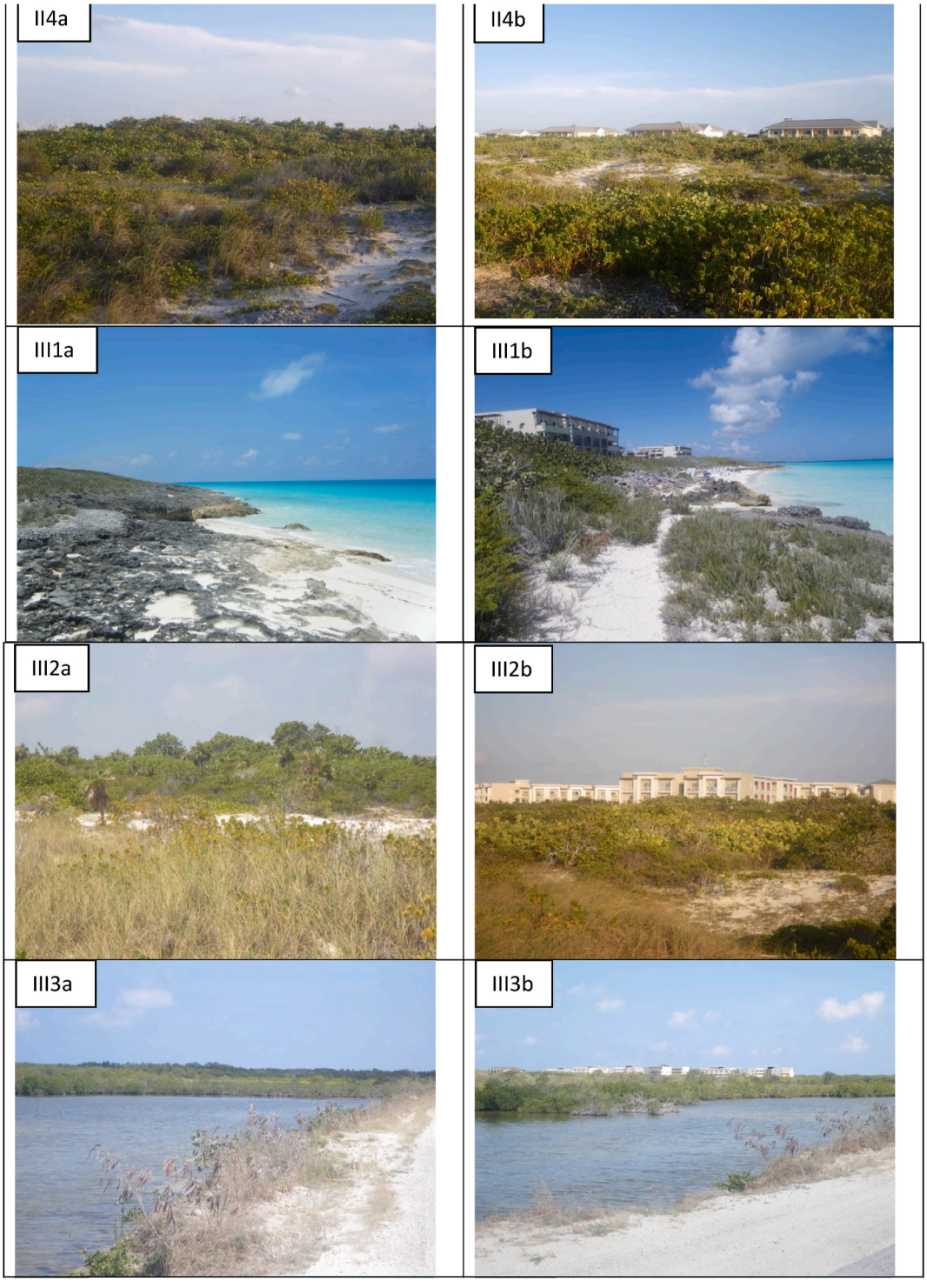


Photo pairs used in the questionnaire. Source: The authors.

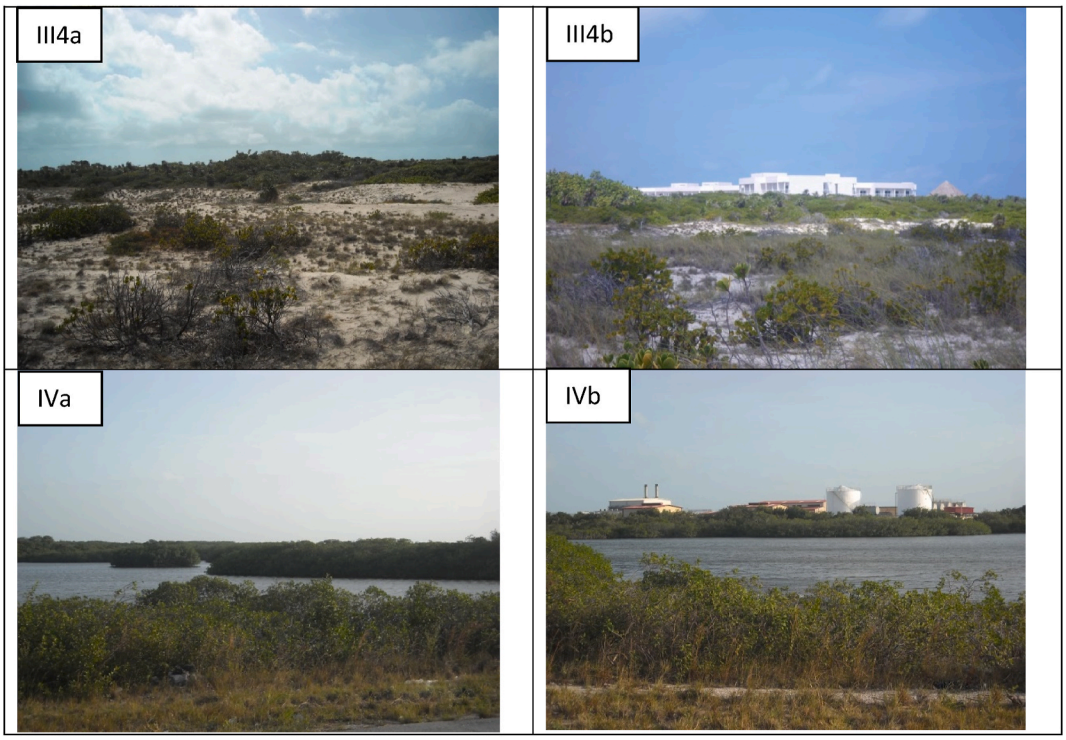


Photo pairs used in the questionnaire. Source: The authors.

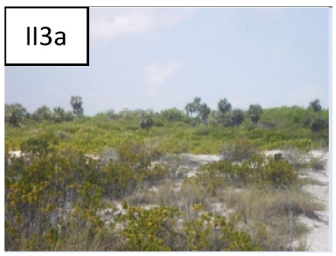
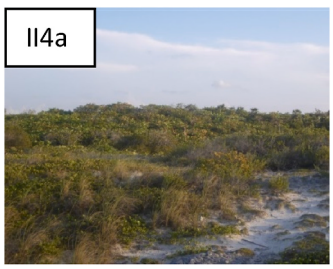
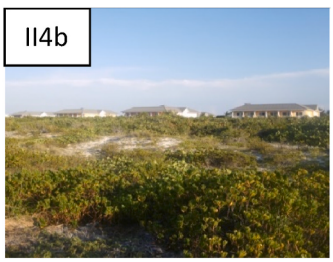
ANNEX III: Correspondence between landscape units with/without constructions and percentage of man-made construction with respect to the total image

Correspondence between landscape units with/without constructions and percentage of man-made construction with respect to the total image. Source: The authors.

Landscape unit name	Landscape units without buildings	Landscape units with buildings
(a/b) Coastal sandy vegetation and coastal and sub-coastal xeromorphic scrub on sand. b) Type I Complexes (4.942 % man-made construction) [13.654 % with footbridge].	Ia 	Ib 

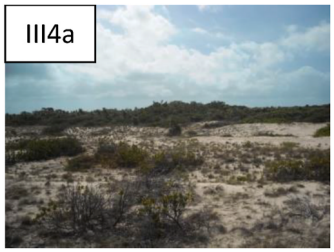
(*continued on next page*)

(*continued*)

Landscape unit name	Landscape units without buildings	Landscape units with buildings
a/b) Beaches with sandy coastal vegetation and marine terraces with rocky coastal vegetation. b) Type II Complexes (2.406 % man-made construction)		
(a/b) Marine terraces with rocky coastal vegetation b) Type II Complexes (1.492 % man-made construction)		
(a/b) Coastal sandy vegetation and coastal and sub-coastal xeromorphic scrub on sand. b) Type II Complexes (2.359 % man-made construction)		
(a/b) Coastal sandy vegetation and coastal and sub-coastal xeromorphic scrub on sand. b) Type II Complexes (3.115 % man-made construction)		
a/b) Marine terraces with rocky coastal vegetation. b) Type III Complexes (3.227 % man-made construction)		

(*continued on next page*)

(*continued*)

Landscape unit name	Landscape units without buildings	Landscape units with buildings
a/b) Grass pasture, xeromorphic scrub and microphyll evergreen forest. b) Type III Complexes (6.693 % man-made construction)		
a/b) Differential accumulation lagoons with mangrove and introduced exotic vegetation. b) Type III Complexes (1.429 % man-made construction)		
(a/b) Coastal and sub-coastal xeromorphic scrub on middle dunes and sandy coastal vegetation. b) Type III Complexes (2.562 % man-made construction)		
a/b) Permanently flooded mangroves b) Logistics base (2.743 % man-made construction)		

ANNEX IV: Universities participating in the study

Universities participating in the study. Source: The authors.

Spain	Brazil
Autonomous University of Madrid	Federal Univ. of Ceará
Complutense University of Madrid	Federal Univ. of Piauí
European University of Madrid	Federal Univ. of Paraíba
Univ. Miguel de Cervantes	Federal Univ. of Rio Grande do Norte
Univ. of Alcalá	Federal Univ. of Pernambuco
Univ. of Zaragoza	Federal Univ. of Sergipe
Univ. of Seville	Federal Univ. of Goiás
Univ. of Granada	Federal Univ. of Viçosa
Polytechnic University of Alicante	Univ. of São Paulo
Polytechnic University of Valencia	São Paulo State University (UNESP)

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(*continued*)

Spain	Brazil
Polytechnic University of Madrid	State Univ. of Santa Cruz (Bahia)
Univ. of Alicante	Federal Univ. of Pará
Univ. of Murcia	Federal Univ. of Maranhão
Univ. of Castilla La Mancha	Federal Univ. of Amazonas
Univ. of Burgos	Federal Univ. of Amapá
Univ. of Navarra	Federal Univ. of Paraná
Univ. of Las Palmas de Gran Canaria	Federal Univ. of Bahia
Catholic University of Valencia	Federal Univ. of Uberlândia
Univ. of Valladolid	Federal Univ. of Roraima
Univ. of Malaga	Federal Univ. of Rio de Janeiro
Univ. Miguel Hernández of Elche	

ANNEX V. Equivalence between Kaplan & Kaplan (1989) variables and other studies

Equivalence between the variables used in different studies and the model proposed by Kaplan (1989) (variables were grouped only for internal use in the comparison).

Equivalence between Kaplan & Kaplan (1989) variables and other studies. Source: The authors.

VARIABLES USED IN THIS STUDY	SIMILARITIES WITH OTHER STUDIES						
	Kaplan & Kaplan (1989)	ART Theory (Kaplan and Kaplan, 1989)	Herzog (1984, 1985, 1987)	(PRP) Theory (Herzog et al., 1997)/(PRS) (Hartig et al., 1996)	Pearce & Lee (2005) (Travel Motive Factors)	Pazhouhanfar & Kamal (Restorativeness Scale)	Lee & Kozar (2008) (Website)
(1) COHERENCE/ HARMONY *"The parts form a harmonious whole".*	YES	Extent	Coherence	Coherence	–	Coherence	COHERENCE
(2) VARIETY/ DIVERSITY/ COMPLEXITY *"There are many different elements".*	YES	Extent	Complexity		–	–	VARIETY
(3) COMPATIBILITY/ LEGIBILITY *"I could do things I like to do here"*	YES	Compatibility	Identifiability, Texture	Compatibility	Relationship, Recognition, Personal Development	Compatibility	LEGIBILITY
(4) FASCINATION/ MYSTERY *"I would like to explore/tour this place"*	YES	Fascination	Mystery, Spaciousness	Fascination	Novelty, Stimulation, Host-site involvement	Fascination	MYSTERY
(5) EVASION/BEING AWAY *"Ideal for being away from my routine"*	NO	Being Away	–	Being Away	Being Away/ Relax, Autonomy, Isolation, Self-Actualize	Being Away	
(6) AESTHETIC APPEAL *"I think it's a beautiful place"*	NO		–		Nostalgia, Romance, Nature	–	–

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