Piazza Riforma

Centro Congressi

Cattedrale di San Lorenzo

The role of urban landscape perception for ancillary spend of visitors to cultural institutions

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The role of urban landscape perception for ancillary spend of visitors to cultural institutions

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Abstract

In the last few decades, many city authorities have invested in cultural projects as a means of boosting the traditional economic activities. Those projects include museums, art galleries, concert halls, exhibitions, festivals, libraries as well as increasing efforts in valorizing historic buildings and monuments. The range of economic benefits that flow from the implementation of these activities goes from benefits, such as jobs supported, ticket sales and revenue generated, not only by and for these projects, but also more widely in their supply chains and the sectors benefitting from audience spend, such as shops, bars, restaurants and hotels.

In this work, we focus on these ancillary revenues and we investigate the role of urban landscape perception on generating them. In fact, several authors have already highlighted the economic value of the beauty of urban landscape, but, in practice, there is still no formal framework to consider directly individual landscape perception on modeling audience decisions. This paper describe a three-step approach to this issue, i.e. conducting standardized urban reality evaluation survey, extracting relevant perception dimensions, and simultaneously estimating the perception of the urban landscape, which is translated into a set of latent variables, and their impact on individual decision.

The empirical context is a relatively small city, i.e. Lugano, Switzerland. For our analysis, we consider the data related to a sample of 500 individuals being involved as audience in different cultural activities. The dataset show that only 29% of the sample does not undertake any complementary activities and almost 45% of it is involved in activities that imply some ancillary revenues.

Results, from the classical Principal Component Analysis methodology, show that, in our context, there are four main dimensions explaining the variability of the preferences, i.e. evaluation of modern/functional sites, historical or traditional sites, cultural sites and nature/green related spaces. By implementing a Hybrid Choice Model we simultaneously estimate a Latent Variable Model and a Discrete Choice Model; the findings suggest that people who have a more positive perception of the city, especially for historic/traditional and cultural sites are more likely to spend money in complementary activities.

Keywords

cultural industries – city development – landscape perception – hybrid choice models

Outline

1. Introduction

1.1 Ancillary revenues of cultural activities

In the last few decades, cultural economics has become an important field of study. City authorities increased their interest for investments in cultural projects as a means of boosting the traditional economic activities. With the aim of improve urban places, these projects include museums, art galleries, concert halls, exhibitions, festivals, libraries as well as increasing efforts in valorizing historic buildings and monuments. Many authors highlighted the importance of cultural industries, because they could increase the city attractiveness and boost regional development through the generation of ancillary revenues. (Scott, 1997)

In this work, we focus on short-term ancillary revenues, i.e. individual spending for complementary goods and services. The range of economic impacts that flow from the implementation of these activities goes from benefits, such as jobs supported, ticket sales and revenue generated, not only by and for these projects, but also more widely in their supply chains and the sectors benefitting from audience spend, such as shops, bars, restaurants and hotels. A statistical report of (UNESCO, 2012), highlights the main approaches followed in the past years in order to measure the economic contribution of cultural activities. In literature, economic impacts are often subdivided into short-term effects and long-term effects. Short term effects refer to ancillary revenues generated by individual spending for complementary activities. In the long run, cultural industries may be able to attract and concentrate private and public investments (Bille & Schulze, 2006). Economic contributions of cultural activities are important for policy makers and local businesses like hotels and shops. A cultural institution generates positive economic multiplier effects, supporting the generation of additional income and therefore sustaining the employment and the social aggregate wealth. The economic impacts of the local culture supply stimulate other economic industries through direct, indirect and induced effects. For instance multiplier effects are achieved thanks to the increased demand for complementary activities or facilities (bars, restaurants, shops, transport, accommodation if tourists and so on) exercised by cultural visitors that induce a production change in the related industries. The owners of the related businesses make profits and increase the demand for investments. The consequence is an increase in employment and household disposable income, which lead to an induced demand for other goods and services in order to satisfy their needs. (Brida, et al., 2011) (Brida, et al., 2013).

The empirical context is a relatively small city, i.e. Lugano, Switzerland. For our analysis, we consider the data related to a sample of 422 individuals being involved as audience in different cultural activities. The dataset show that only 29% of the sample does not undertake any complementary activities and almost 45% of it is involved in activities that imply some ancillary revenues.

1.2 Landscape perception overview

Following a three-step approach to this issue, i.e. conducting standardized urban reality evaluation survey, extracting relevant perception dimensions, and simultaneously estimating the perception of the urban landscape, which is translated into a set of latent variables, and their impact on individual decision, allowed us to investigate the role of urban landscape perception on generating ancillary revenues.

Several authors have already highlighted the economic value of the beauty of urban landscape, but, in practice, there is still no formal framework to consider directly individual landscape perception on modeling audience decisions. Many works focused on the estimation of the monetary value for landscape components, by assessing willingness to pay for different landscape attributes. Tagliafierro et al. (2013) investigated through an imaged-based Choice experiment method the role of individual perception on the monetary valuation of landscape attributes. With a Principal Component Analysis they found six main landscape and ten landscape subtypes in the area of the Peninsula of Sorrento. Thereafter they estimated the effect that each landscape attribute and respondents' characteristics have on the probability of choosing to protect the current landscape. Many authors focused in estimating the WTP for "green" related elements, e.g. Majumdar, et al., 2011 estimated the willingness to pay of tourists for urban forests using contingent valuation. Mmopelwa et al. (2007) assessed the WTP of tourists for park fees in the Moremi Game Reserve. Martín-López et al., (2007) studied individuals' attitudes behind the WTP for biodiversity conservation. Lee & Han (2002) estimated the use and preservation values of national parks' tourism resources. Verbič & Slabe-Erker (2009) measured the WTP for environmental goods with embodied natural and cultural heritage.

It is logical to assume that individuals' behavior in the sense of willingness to use the city as a place to spend time and money for recreational purposes, may be affected by a latent variable represented by the perception of the territory. This set of latent variables can be measured by the evaluation of some sites or major point of interest of the city, selected according to their importance in the urban reality. In the survey respondents were asked to evaluate 18 images representing the major point of interest of the city. Thus, it has been possible to identify which sites are the most known and especially which of them are evaluated and perceived in the best way. A Principal Component Analysis was implemented, in order to reduce the evaluation variability into a set of independent principal components. Through this analysis it has been possible to identify 4 main dimensions affecting individual urban landscape perception, i.e. evaluation of modern/functional sites, historical or traditional sites, cultural sites and nature/green related spaces.

We implemented a discrete choice model and in order to test whether the urban landscape perception plays an important role in the decision process, we simultaneously estimated an Integrated Choice and Latent Variable (ICLV) model. In particular the 4 dimensions affecting individual perceptions found with the PCA, were included as explanatory variables in the choice model.

In addition to individual socioeconomic characteristics (especially level of income and age), our estimates suggest that urban landscape perception play an important role for cultural institutions users in spending decisions for complementary activities. Historical or traditional sites and cultural sites have high explanatory power on modeling these choices.

2. Data and Empirical context

The empirical context is a relatively small city, i.e. Lugano, Switzerland. For our analysis, we consider the data related to a sample of 422 individuals being involved as audience in different cultural activities. The interviews were conducted during 9 main types of events: (a) Classical music [85]; (b) Theatre [63]; (c) Dance performance [62]; (d) Cinema [53]; (e) Art Gallery (Vernissage) [47]; (e) Music Performance [40]; (f) Pop/rock concerts [39]; (g) Comedy [25]; (h) Piano performance [8].

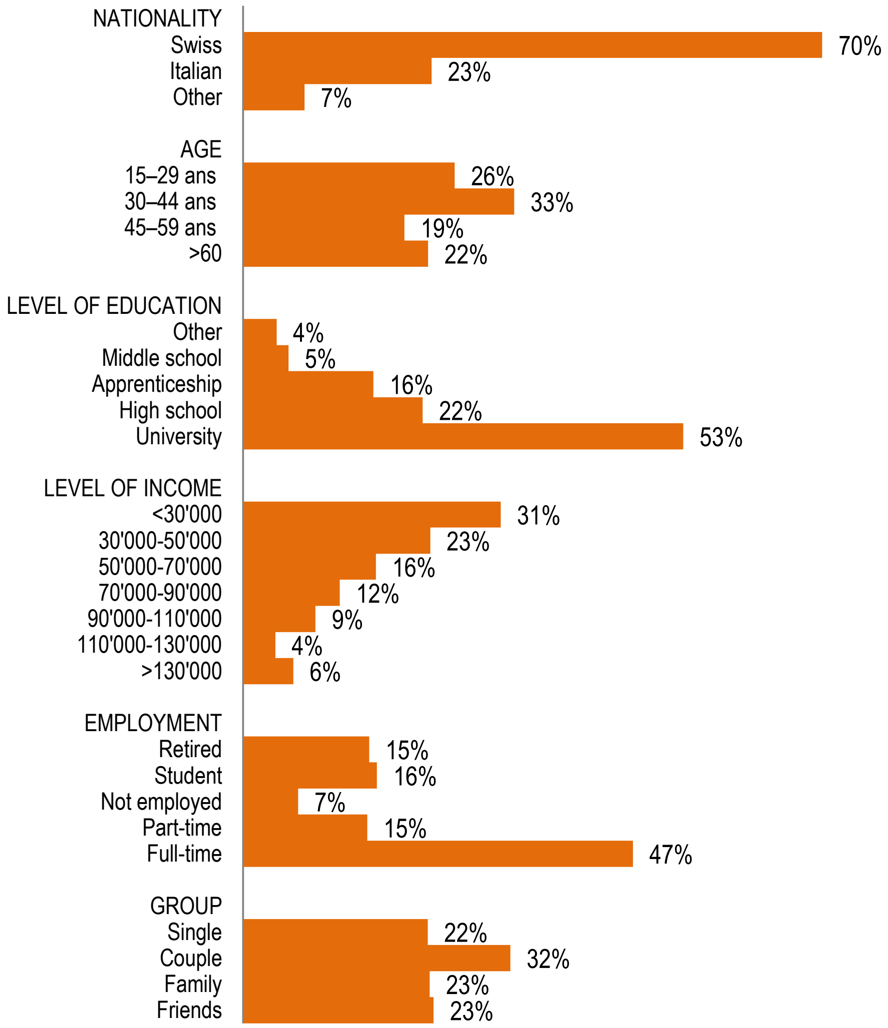
These events were hosted by Centro Congressi, Studio Foce, Cittadella 2000, Cinestar, Museo Cantonale d'Arte, Museo d'Arte Villa Malpensata, Cinema Iride. Centro Congressi has been built in 1975 and is currently hosting various cultural events (e.g congresses, concerts, ballets, theaters). While the building of Nuovo Studio Foce, originally constructed in 1938 to host Radio Monteceneri, was renovated in 2002 in order to host cultural events such as music, theater and dance performances. Cinestar is a cinema, whose building has seven projection rooms and it is a cultural institution able to attract many users. Cittadella 2000 is provided both by theatrical and cinematographic equipment. It is active in the cultural sector of Lugano since 2000. The Museo Cantonale d’Arte (Cantonal Art Museum), which opened in 1987, is located in the center of Lugano and it is located in an historical building edified after 1400. Its exhibitions deal with very different themes ranging from painting to sculpture, from photography to video, from architecture to graphics. Museo d’Arte Villa Malpensata is located in Villa Malpensata and was built in the 18th century. In 1893 Antonio Caccia donated the villa to the city of Lugano. In 1960 the city started the renovations to transform it into a museum. Cinema Iride is a small cinema infrastructure inside Quartiere Maghetti, located in the city center.

Table 1 The Interviews

Site/Event	# Events	# Respondents	% of Sample	Interviews/ Event
Centro Congressi	18	169	40.05	9.39
Studio Foce	14	118	27.96	8.43
Cinestar	3	30	7.11	10.00
Museo Cantonale d’Arte	4	34	8.06	8.50
Museo d’Arte	1	13	3.08	13.00
Cittadella 2000	6	35	8.29	5.83
Cinema Iride	5	23	5.45	4.60
TOTAL	*51*	*422*	*100.00*	*8.27*

We notice first from Figure 1 that these institutions are attended by many people aged 30-44 years old (33%) and by people aged between 15 and 29 years (26%). Also people aged 45-59 (19%) and over 60 years old (22%) are culturally active. The respondents were mainly Swiss (70%) and Italian (23%), while in the remaining 7% are included people of German, Brazilian, Japanese, Dominican, U.S., Russian, Spanish, French, British, Cuban, Danish, Croatian, Armenian, Albanian, Argentina and Serbian nationality. These cultural institutions are attended mostly by people with a university degree (53%) and more in general we observe that the level of education is a very important variable for people culturally active. The respondents stated that their annual income (in CHF) was: less than 30’000: 31%; between 30’000 and 70’000: 39%; more than 70’000: 31%. As for the employment we notice that visitors are mainly full-time workers (47%), students (16%) and retired people (15%). Finally most of people attend cultural institutions in pairs (32%), with the family (23%) or with friends (23%), even if there is a large share (22%) of people attending cultural events alone.

Figure 1 Socioeconomic characteristics of the sample

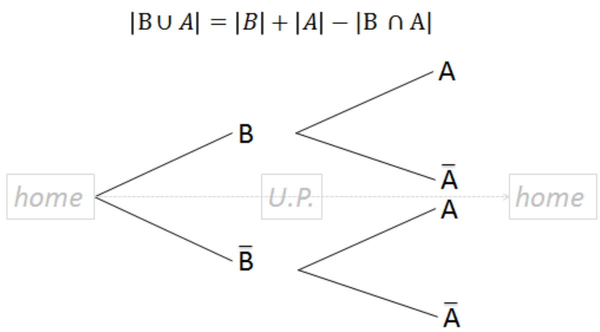


2.1 Complementary activities and spending decision

Cultural events, organized in strategic point of interest in the city, may generate ancillary economic revenues in terms of spending for related goods and services offered by the city's attractions. If we take a generic individual attending a cultural event, before and after this event he could decide to undertake some complementary activities such as going to the bar, to the restaurant, to shopping, to practice outdoor activities or even other cultural activities. By taking a sample of visitors to cultural institutions, we can study and measure how many of them have undertaken an activity, before and after the event, whether outside or in the city where the event is organized.

The approach followed is based on the analysis of how people behave before-and-after a visit to a certain urban project (u.p.). With the questionnaire respondents were allowed to indicate the place on a map where they were before the event and the activity that they were undertaken. The same applies for what concerns the moment after the event. With this method it has been possible to identify people who came or went to home, people who undertake an activity outside of Lugano and visitors who decided to stay in the City of Lugano, where the cultural events were organized.

Figure 2 Combinations of activities



In this way, we are allowed to assume that individuals make two sequential choices in order to have a "combination of activities". The decision maker may choose to practice a complementary activity just before, just after, or both before and after the event. Hence, we get a combination of activities that is merely the union of the two decision-making moments as shown in Figure 2. The decision maker makes two choices: (a) whether to undertake an activity before the event, including the eventual activity directly at the urban project (B), or nothing ($\bar{B}$) and then (b) whether to undertake an activity after the event (A) or not ($\bar{A}$). Therefore, for our purpose it should be counted the cardinality of the outcome "undertaking an activity before or after", i.e.$|B \cup A|$.

In Table 2 it is remarkable that only 28.9% of respondents did not undertake at least one activity. The most frequent combinations of activities (except do nothing) are:

1. Bar – *u.p.* – Home: 12.3%;
2. Restaurant – *u.p.* – Home: 9.7%;
3. Home/Work – *u.p.* – Bar: 8.7%;
4. Bar – *u.p.* – Bar: 4.3%;

Going back to the simple relationship shown in Figure 2, on a sample of 422 individuals we can use the relation $|B \cup A| = |B| + |A| - |B \cap A|$ to define how many people have done something before and after, respectively, the intersection or the union of the two events. From the sample it emerges that:

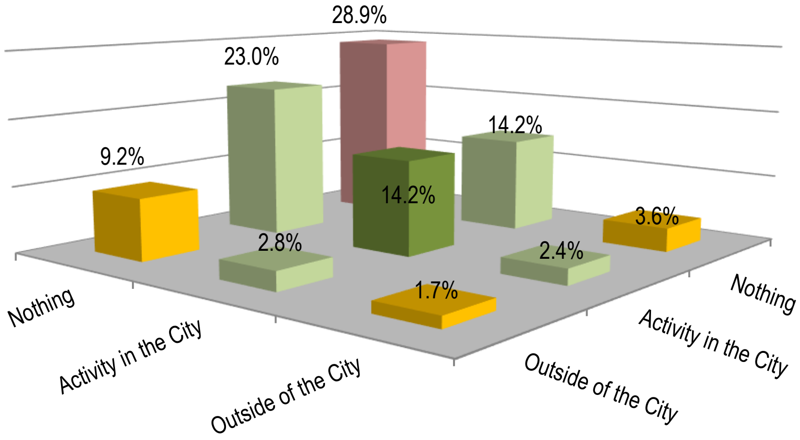
- $|B \cup A| = 300$ (71.1%) individuals undertook at least one activity, while
- $|B| = 225$ (53.3%) before the event,
- $|A| = 164$ (38.9%) after the event and
- $|A \cap B| = 89$ (21.1%) of which both before and after.

Table 2 Activities before (rows) and after (columns) the event. (in % of total individuals)

BEF/AFTER	Home	Restaurant	Bar	Shopping	Cultural activities	Outdoor activities	Other activities	*TOTAL BEFORE*
Home/Work	28.9	5.2	8.7	0.2	0.5	2.4	0.7	*46.7*
Restaurant	9.7	0.2	2.1		0.5	0.5	0.2	*13.3*
Bar	12.3	1.9	4.3		0.7	0.7		*19.9*
Shopping	1.4	0.2	1.2		0.2	0.5		*3.1*
Cultural activities	1.4		0.2		0.7	1.4		*2.8*
Outdoor activities	5.0	2.1	1.9			0.2		*10.4*
Other activities	2.4	0.7			0.2		0.2	*3.8*
TOTAL AFTER	*61.1*	*10.4*	*18.5*	*0.2*	*2.8*	*5.7*	*1.2*	*100.0*

At this point it is crucial to measure how many of them chose the city as a zone-end destination, in order to clarify if there are positive impacts directly for the city that hosts the cultural event, given that people are attracted by its facilities or premises.

Figure 3 Combination of activities before and after – zone choice



As shown in Figure 3, 28.91% of respondents did not undertake a complementary activity neither before nor after, while by subtracting the combinations Nothing – Nothing (28.91%), Outside of the City – Outside of the City (1.66%), Nothing – Outside of the City (9.24%) and Outside of the City – Nothing (3.55%), we get that 56.64% of respondents undertook at least one activity in the city hosting the cultural event. This is an interesting result, since more than one out of two visitors undertake an activity in the city, meaning that the city could benefit from these events.

With respect to the whole sample, 184 (44%) visitors decided to undertake an activity in the city which implies an expenditure.

Table 3 Summary statistics of people who spent money in the city (184 individuals)

Average expenditure (in CHF)	41.54
Standard deviation	89.04
Minimum	2
Maximum	1104

2.2 Urban landscape perception

The set of independent variable that characterize the perception of territory, i.e. psychological variables related to the perceptions of different zones and projects, are summarized and described in this section. Afterwards these results are implemented in the discrete choice framework described in chapter 3.

It is logical to assume that individuals' behavior in the sense of willingness to use the city as a place to spend time and money for recreational purposes, may be affected by a latent variable represented by the perception of the territory. This set of latent variables can be measured by the evaluation of some sites or major point of interest of the city, selected according to their importance in the urban reality. A researcher observes an evaluation (likert scale), which then is transposed into a set of latent variables that might be defined according to different preferences for the areas containing historical sites, rather than modern, and so on.

In the survey respondents were asked to evaluate 18 images representing the major point of interest of the city. Thus, it has been possible to identify which sites are the most known and especially which of them are evaluated and perceived in the best way. A summary statistics is reported in the next sections.

A Principal Component Analysis was implemented, in order to reduce the evaluation variability into a set of independent principal components. The principal components can be easily interpreted, and through this analysis it has been possible to identify 4 main dimensions affecting individual urban landscape perception.

2.2.1 Principal Components Analysis on urban landscape perception

The Principal Component Analysis (PCA henceforward) is a statistical technique applied in order to reduce the complexity of a set of variable into a set of uncorrelated principal components. In our context the principal components are latent variables which explain the variability of territory perception among individuals. Each component is a linear combination of the factor weights and the sites' variables. The dimensions affecting the perception of the city are related to the intensity of the factor loadings given each site.

We have N individuals that were asked to evaluate $p = 18$ major point of interest of the city. Given a vector X of size $(p\ x\ 1)$, the PCA aims to determine p unobservable Y new variables, which are linear combinations of the X variables. Afterwards the variance of Y_k $(k = 1,..,p)$ is maximized. Let us define S as the variance-covariance matrix of the X variables. The variances of the principal components are given by the eigenvalues of S, sorted in decreasing order and the components coefficients are the respective eigenvalues. Thus the system for the variable Y will be defined as $Y = A'X$, where A is the orthogonal matrix having the sorted eigenvalues of the matrix S. We can rewrite the equation system as $X = AY$, since A is orthogonal and invertible. If the first principal components in Y are sufficient to explain the variance of the model, therefore we will have $p - m$ other components which are only disturbance terms and can be in general indicated as η. Therefore we can rewrite the relation as $X = A_m Y_m + \eta$, where Y_m is the vector of the m latent factors which we aim to investigate. (Mignani & Montanari, 1998)

Hence we can represent the latent factors as a linear combination of the $X_1, \ldots, X_p$ variables multiplied by the associated weights a_{ij}:

$$\begin{cases} Y_1 = a_{11}X_1 + \cdots + a_{1p}X_p \\ \cdots \\ Y_m = a_{m1}X_1 + \cdots + a_{mp}X_p \end{cases}$$

A further step often applied is the rotation of the factorial axis, in order to enhance and underline the factor weights and therefore to make more clear their interpretation. In our case we applied the VARIMAX method, introduced by Kaiser which maximizes the sum of the variances of the squared loadings (factorial weights). (Mignani & Montanari, 1998)

In order to infer whether this method can be applied to the sample it is used the Bartlett's test of sphericity in order to verify if there are significant interdependencies among the observed variables; in fact, if the variables are uncorrelated, no components can be found. Therefore by rejecting the null hypothesis we state that the variables are not orthogonal (Ferré, 1995). A further method applied is given by the Keiser-Meyer-Olkin (KMO) measure of sampling adequacy, which is an index ranging from 0 to 1 and a value higher than 0.6 is considered sufficient in order to factorize the variables. (Leech, et al., 2005)

Table 4 PCA results

	Principal Components			
	C 1	**C 2**	**C 3**	**C 4**
Piazza Riforma	.271	**.666**	.110	-.092
Centro Congressi	**.605**	.294	-.061	-.033
San Lorenzo	-.135	.469	.480	.107
Museo delle Culture	-.133	.038	**.702**	.247
Pensilina dei bus	**.679**	-.035	.098	.194
Villa Ciani	.041	**.671**	.076	.414
Chiesa S. Rocco	-.033	.493	**.627**	.005
Centro Esposizioni	**.647**	.149	-.199	.228
Casinò	**.661**	.104	-.115	-.015
Museo d'Arte	.043	-.016	**.631**	.351
Fun. Monte Brè	.137	**.566**	.197	.380
Biblioteca Cantonale	-.045	.075	.410	**.698**
Chiesa Evangelica	.123	.239	**.638**	-.066
Via Nassa	.186	**.716**	.189	.089
Banca del Gottardo	**.511**	.169	.492	-.150
Autosilo Balestra	**.675**	.021	.171	.006
La Lanchetta	.417	.402	.032	.050
Lungo fiume Cassarate	.274	.227	-.004	**.591**

Both KMO (index = 0.842 > 0.6) and Bartlett's test of sphericity (reject the null hypothesis of non-correlation) allow us to implement the PCA.

We applied the PCA using SPSS software. With the rotation using VARIMAX method for the rotated factor weights and taking the eigenvalues higher than 1, we identified 4 components, which in total explain more than 52% of the total variance.

The 4 components affecting the perception of the sites can be interpreted from the intensity of the factor loadings. As said before each component is a linear combination of the factor weights and the variables X. For each factor there can be isolated the most important factor weights (i.e. we arbitrary chose loadings higher than 0.5) and what are the sites affecting at most these components.

Component 1 – Modern sites preferences (15.7% of total variance)

The first component is influenced by modern building such as:

a) transport related infrastructures, i.e. Autosilo Balestra (car park), Pensilina dei Bus (bus shelter);
b) Centro Congressi (Congress center), Centro Esposizioni (exhibition center),
c) other infrastructures with high physical impact on the territory, i.e. Banca del Gottardo (modern building hosting banking activities), Casino of Lugano.

Component 2 – Historic or traditional sites of the city (14.5% of total variance)

The second dimension is affected by historic sites or places that identify the city:

a) Piazza Riforma (the square is the hub of the city's activities),
b) infrastructures with historical features or directly recalling different concepts, such as the Pillars of Via Nassa (recalling Via Nassa, the "shopping street") or Villa Ciani, Funicolare Monte Brè (historic funicular);

Component 3 – Cultural sites preferences (14% of total variance)

The third component could be imagined as the preferences for the sites which recall the culture or are simply interesting from an artistic point of view:

a) cultural institutions, i.e. Museo d'Arte (Art museums), Museo delle culture (exhibitions about cultures);
b) religious infrastructures of various types, which obviously have a certain visual and emotional impact that vary across individual groups (Chiesa San Rocco, Evangelica Riformata nel Sottoceneri);

Component 4 – Nature/green spaces related sites (8.2% of total variance)

The last identified dimension is related with natural or green spaces:

a) Lungo Fiume (long river);
b) Biblioteca cantonale (cantonal library) which is located in the city's park.

Only two sites are difficult to attribute to a specific latent factor, i.e. La Lanchetta (restaurant) and Cattedrale San Lorenzo (cathedral). La Lanchetta, as shown in Table 4, could be more related with the first factor, while Cattedrale San Lorenzo is important both from the historic (F2) and cultural attributes (F3).

2.2.2 Descriptive statistics of the sites

The selected sites are well distributed on the territory of Lugano, then their evaluation could have a significant impact on individual city's image perception. For more information about the survey please refer to Appendix 1.

Figure 4 Known sites of Lugano

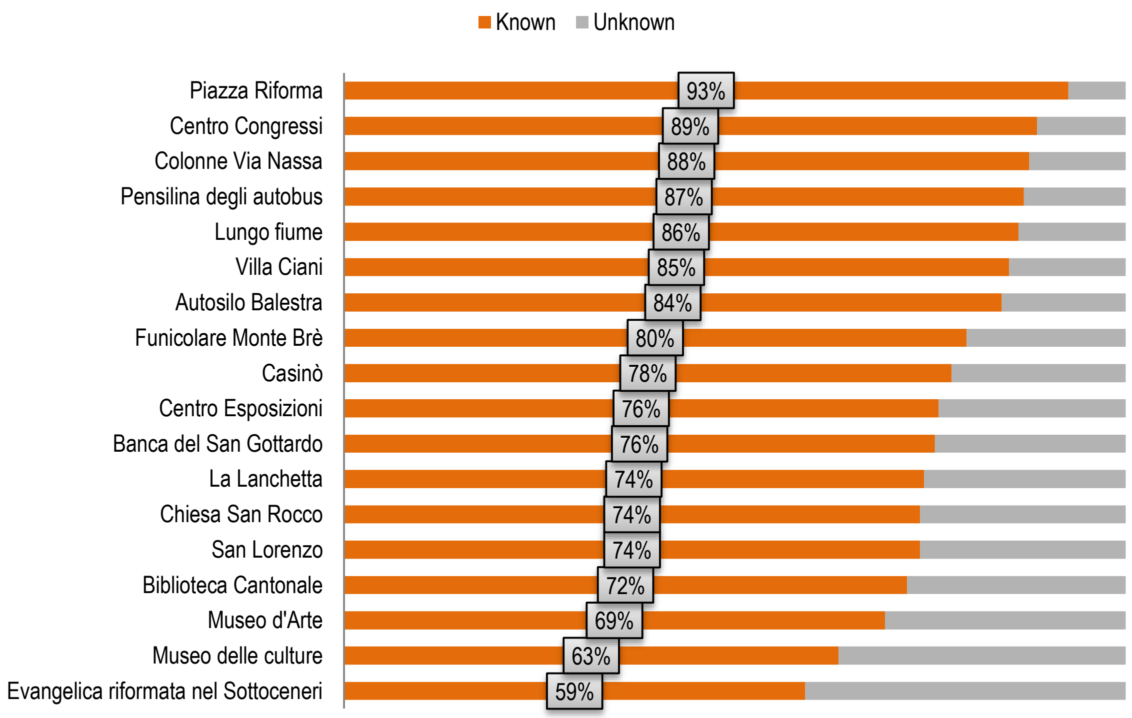
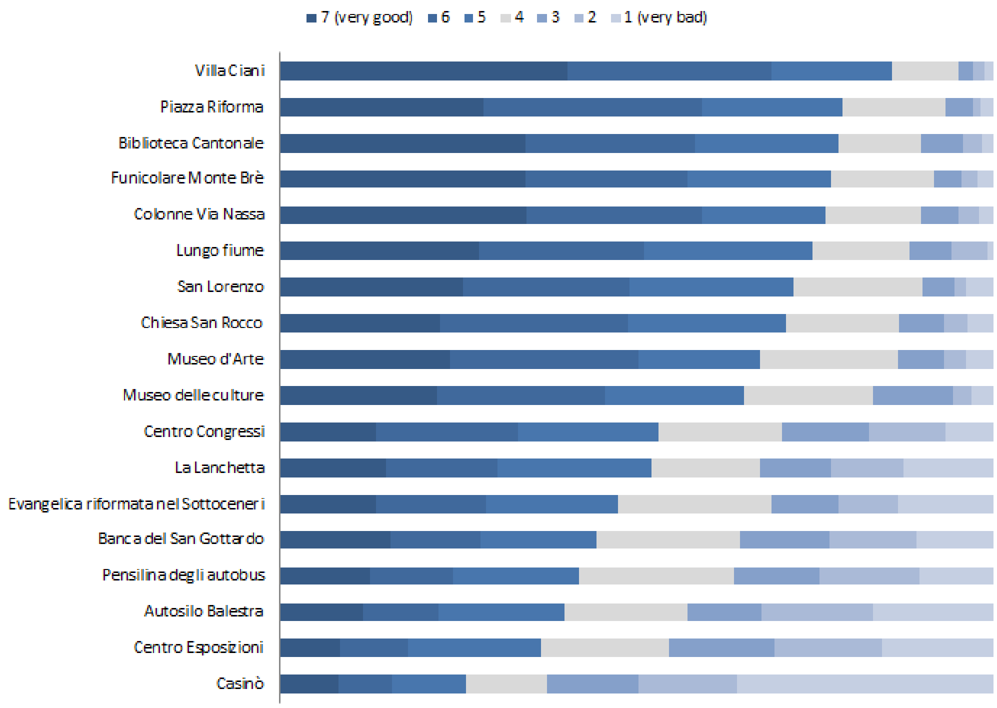


Figure 4 depicts which are the most popular (known) sites of Lugano. The most known are Piazza Riforma (93%), Centro Congressi (89%) and the Pillars of Via Nassa (88%), while the less well-known sites are religious infrastructures such as the Evangelica Riformata nel Sottoceneri (59%) or some cultural institutions like Museo delle Culture (63%) and Museo d'Arte (69%).

In figure 5 there are reported the evaluations of these sites, only if they were known. The sites that are evaluated in the best way are Villa Ciani (average 5.87), Piazza Riforma (average 5.56) and Biblioteca cantonale (average 5.55. While we see that the Casino of Lugano (average 3.02) is evaluated very negatively. Consequently it can be seen how the evaluations on the transport-related infrastructure are purely indifferent, e.g. Pensilina dei Bus (4.08), Autosilo Balestra (3.82). In fact their particular architectural styles may not be appreciated, but this is compensated from the point of view of their usefulness. These evaluations can provide a very interesting starting point for analyzing the potential existence of latent variables such as the perception of different dimensions of the urban landscape, e.g. historical, modern and so on.

Figure 5 Sites Evaluation, only if known



	Average	St.dev	CV
Villa Ciani	5.87	1.29	22.0%
Piazza Riforma	5.56	1.35	24.3%
Biblioteca Cantonale	5.55	1.48	26.6%
Funicolare Monte Brè	5.54	1.47	26.6%
Colonne Via Nassa	5.54	1.50	27.2%
Lungo fiume	5.35	1.48	27.6%
San Lorenzo	5.28	1.52	28.8%
Chiesa San Rocco	5.19	1.55	29.9%
Museo d'Arte	5.18	1.59	30.7%
Museo delle culture	5.07	1.57	31.0%
Centro Congressi	4.47	1.78	39.8%
La Lanchetta	4.30	1.93	45.0%
Evangelica riformata nel Sottoceneri	4.24	1.90	44.8%
Banca del San Gottardo	4.19	1.90	45.4%
Pensilina degli autobus	4.08	1.84	45.2%
Autosilo Balestra	3.82	1.97	51.6%
Centro Esposizioni	3.72	1.85	49.7%
Casinò	3.02	2.03	67.2%

3. Choice model framework

We implemented a discrete choice model and in order to test whether the urban landscape perception plays an important role in decision process, we simultaneously estimated an Integrated Choice and Latent Variable (ICLV) model. In particular the 4 dimensions affecting individual perceptions found with the PCA, were included as explanatory variables in the choice model.

3.1 Classical discrete choice framework

In the classical discrete choice model framework we normally assume a sample of N individuals, where the decision maker is denoted with $n \in \{1,2, \dots N\}$. In general we have a universal choice set C, while the context, the time and budget constraints and other externalities determine the choice set $C_n \in C$ of the decision maker. It is assumed that individual in the choice process, maximizes its utility, so it has consistent and transitive preferences among the different alternatives. The choice depends on the socioeconomic characteristics of the decision maker, such as income, level of education, age, nationality or sex. Moreover choices are influenced by the attributes of the alternative i, for instance the price, the distance, travel time and so on. We denote the vector of characteristics of the decision maker with S_n, and the vector of attributes of the alternatives as z_{in}. Since both socioeconomic variables and alternative attributes are observable, we denote it as $x_{in} = z_{in} + S_n$. (Ben-Akiva & Lernman, 1985)

Using Lancasters's approach we can define the utility function in terms of attributes and socioeconomic characteristic, so as to obtain: $U_{in} = U(x_{in})$. The decision maker has certain preferences through which maximizes his utility. If we consider a situation where the decision maker is subjected to a binary choice, he will choose the alternative that maximizes his utility and indirectly the attributes of the alternative that he prefers, as well as the choice will be correlated to its socio-economic characteristics: $U(x_{in}) > U(x_{jn})$.

At the empirical level, it was found that the individual preferences sometimes were not consistent and transitive. Within a sample could be observed that individuals with the same choice set and with the same socio-economic characteristics taken into consideration, do not take same choices. These discrepancies with the theory of individual behavior have led to refine models and treat the probabilistic theory of choice (Random Utility Models, RUM henceforward). Human behavior is influenced by many factors, some of which are unobservable to the researcher. For this reason we talk about random utility approach, where it is always assumed that the individual chooses the alternative that maximizes his utility, but the approach used is probabilistic, then the utility is treated as a random variable because the researcher is not able to identify all the variables that affect the probability of a choice. Those unobservable components which can not be directly inserted in the utility functions are summarized in (a) unobserved attributes, (b) unobserved taste variations, (c) measurement errors and imperfect information, (d) instrumental variables (Ben-Akiva & Lernman, 1985). Thus, in general, the utility will be composed of an observed part $V_{in} = V(x_{in})$ and an unobserved part $\varepsilon_{in} = \varepsilon(x_{in})$, so that $U_{in} = V_{in} + \varepsilon_{in}$ is the random utility of the decision-maker.

The probability that individual n adopts the alternative i is equal to the probability that the utility of i is greater than or equal to the utility of the other alternatives $j \in C_n$, therefore: $P(i|C_n) = \Pr\left[V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn},\ all\, j \in C_n\right]$. In the simplest case of a binary choice, we have two alternatives i and j, then the probability that an individual choose alternative i is equal to the probability that the difference between the deterministic components $V_{in} - V_{jn}$ is greater than the differences of the unobservable components $\varepsilon_n = \varepsilon_{jn} - \varepsilon_{in}$.

$$P(i|C_n) = \Pr\left(V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn}\right) = \Pr\left(\varepsilon_{jn} - \varepsilon_{in} \leq V_{in} - V_{jn}\right) = \Pr(\varepsilon_n \leq V_{in} - V_{jn})$$

Assuming a logistic distribution for the error term ε_n and also for $V_{in} - V_{jn}$, the probability of choosing alternative i is:

$$P(i) = \Pr\left(U_{in} \geq U_{jn}\right) = \frac{e^{\mu\beta' x_{in}}}{e^{\mu\beta' x_{in}} + e^{\mu\beta' x_{jn}}}$$

β is the vector of the coefficient that we want to estimate, and x_{in}, x_{jn} are the matrix that contain the attributes of the alternatives and the characteristics of the individual n. (Ben-Akiva & Lernman, 1985)

3.2 Integrated Choice and Latent Variable model (ICLV)

The Integrated Choice and Latent Variable (ICLV) models belong to Hybrid Choice Model family. In order to relax the basic Random Utility Models assumptions, researchers have extended the discrete choice modeling framework and developed a wide and rich literature on hybrid choice models (HCM), which allow to better understand consumers' behavior (Ben Akiva, et al., 2002). With this new approach it has been possible to model individual choices by incorporating not only systematic components of the utility functions (i.e. socioeconomic characteristics and alternatives' attributes), but also attitudes, psychological and cognitive processes which may also vary across individuals. In our context this extension of discrete choice theory is important, because the aim is to model individual urban landscape perception and the impact on spending decisions in the city. In fact we model explicitly the urban perception, treated as a latent variable.

The latent variable is not directly observable, although it can be captured through some indicator functions that the researcher observes, i.e. in our context through the likert scales on the urban landscape evaluation. The latent variable is a function of individual socioeconomic characteristics, meanwhile the latent variable influences the urban landscape evaluation. In addition the latent variable is treated as an explanatory variable in the choice model, because we want to model its effect on individual spending decision. It is therefore clear that the idea is to implement Structural equation modeling (SEM), or simultaneous equations estimation; a variable from one part is treated as independent, from the other as dependent, and the simultaneous estimation of these equations allows us to obtain an unbiased estimate.

As shown in Figure 6, in our model specification two components can be distinguished, a binary choice model and a latent variable model. These two components are each composed by **(1) structural** and **(2) measurement equations**. In **(3)** we give the **Likelihood function** of the ICLV model. Following Walker (2001) (or for instance Ben-Akiva and Walker (2002)) approach, our ICVL model can be defined as follows. (Walker, 2001) (Ben-Akiva & Walker, 2002)

(1) The structural equations for (a) the choice model and (b) the latent variable model.

(a) The RUM part is given by the binary logit choice model and is expressed as follows:

$$U_{in} = V_{in}(x_{in}, x_n^*; \beta) + \varepsilon_{in}, \text{ where } \varepsilon_{in} \sim EV(0,1)$$

We assume now that the systematic (or deterministic) part of the utility $V_{in}(x_{in}, x_n^*; \beta)$ depends on a vector of observed variables x_{in} given in our case by the socioecomic characteristics of the respondent, and a vector of latent characteristics x_{in}^* which includes the individual perception. The vector β represents the coefficients of independent variables marginal utilities affecting the whole individual utility function U_{in}. ε_{in} is the random term representing unobserved components and is Extreme Value distributed. Since the aim is to model individual spending decision, we suppose that decision makers, in our context, can take two decisions, (1) Spending in the city for complementary activities (EXP) or (2) not spending (NOEXP). NOEXP alternative also includes people who still decided to stay in the city but who did not undertake any activity that implies money spending. Hence, the discrete choice model can be summarized by:

$$\begin{cases} U_{EXPn} = V(\, x_{nEXP}, x_n^*; \beta) + \varepsilon_{EXPn} \\ U_{NOEXPn} = V(\, x_{nNOEXP}, x_n^*; \beta) + \varepsilon_{NOEXPn} \end{cases}$$

Assuming that $(\varepsilon_{EXPn} - \varepsilon_{NOEXPn}) \sim Logistic(0,1)$, the model take the form of the binary logit choice model,

$$P(EXP) = \Pr(U_{EXPn} \geq U_{NOEXPn}; \beta) = \frac{e^{V(x_{nEXP}, x_n^*; \beta)}}{e^{V(x_{nEXP}, x_n^*; \beta)} + e^{V(x_{nNOEXP}, x_n^*; \beta)}}$$

(b) The second structural equation is the Latent Variable Model, which we can simply express as a linear factor model, i.e. $x_n^* = x_n\lambda + \omega_n$. x_n^* is a vector of individual latent variables, λ includes the factor loadings affecting the latent variable given the vector of socioeconomic characteristics x_n. ω_n are the measurement errors and are independent and identically multivariate normally distributed, i.e. $\omega_n \sim N(0, \Sigma_\omega)$.

(2) Measurement Equations for (a) the latent variable model and (b) the choice model.

(a) The latent variable is an hypothetical construction of the researcher, thus by allowing endogeneity with SEM, the indicator r of the urban perception, I_{rn}, is a function of the x_n^* individual latent variable. α_r , as explained in Figure 6 are the factor loadings on the latent variable of the measurement equations $I_{rn} = x_n^*\alpha_r + \nu_{rn}$, with $r = 1, \ldots, R$; and $\nu_n \sim N(0, \Sigma_\nu)$. Although the perception measurement equations, i.e. the indicators, have an ordinal outcome (likert scale from 1 to 7), they can be approximated and treated as continuous variables. In fact we could as well assume that $\nu_n \sim Logistic(0, \Sigma_\nu)$, hence each indicator will be treated as ordinal.

(b) The measurement equation for the Choice Model is $y_{in} = \left\{1,\ if\ U_{in} = \max_i(U_{in})\ ;\ 0, otherwise\right\}$, that is each individual n of the sample chooses an alternative i, that maximizes his utility under RUM.

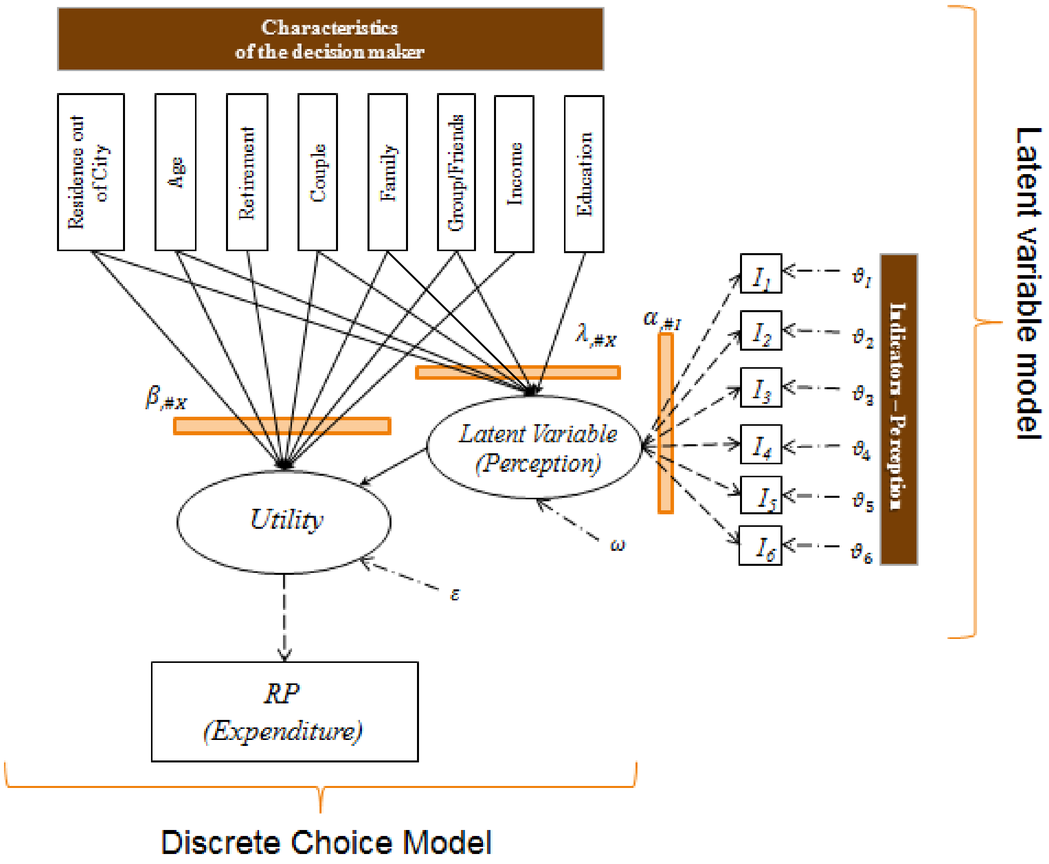
(3) Probabilities and likelihood function

By assuming that ε_{in}, ω_n and ν_n are independent, the individual likelihood function of our model is given by the following multidimensional integral:

$$f(y_{in}, I_{rn} | X_n; \alpha, \beta, \lambda, \Sigma_\varepsilon, \Sigma_\omega, \Sigma_\nu) =$$
$$= \int_{x^*_n} \frac{e^{V(x_{nEXP}, x_n^*; \beta)}}{e^{V(x_{nEXP}, x_n^*; \beta)} + e^{V(x_{nNOEXP}, x_n^*; \beta)}} \prod_{r=1}^{R} \frac{1}{\sigma_{\nu_r}} \phi \left[\frac{I_{nr} - x_n^*\alpha_r}{\sigma_{\nu_r}}\right] \frac{1}{\sigma_\omega} \phi \left[\frac{x_n^* - X_n\lambda}{\sigma_\omega}\right] dx^*$$

Notice that choice model and latent variable are simultaneously estimated. The first part is composed by the choice model, the second one by the latent variable model. The integral is evaluated with the aid of simulation techniques for approximations, since it does not consist in a closed-form solution. The proposed approach is the Maximum Simulated Likelihood Estimation (Ben-Akiva & Walker, 2002). Integration simulation techniques with Halton sequences and alternative simulators by generating synthetic data from the specified model structure for instance, are widely applied in order to estimate such a complex model (Train, 2009). Our models were estimated with Python Biogeme Software (Bierlaire & Fetiarison, 2009).

Figure 6 Model Framework: Hybrid Choice Model



Source: adapted from (Ben-Akiva & Walker, 2002)

3.3 Application of ICLV model and results

As depicted in Table 5, we implemented a base model *M1*, without latent variable, which is a simple binary logit, afterwards we estimated 4 additional models *M2*, *M3*, *M4*, *and M5* that include four different latent variables. These models respectively take into account for latent variables related to the perception of modern/functional sites (M2), historical or traditional sites (M3), cultural sites (M4) and nature/green related spaces (M5), which come from the PCA results. The results of the Latent Variable Model structural Equation are reported in Table 6. The indicators, i.e. measurement equation, of the latent variables and the estimation results are reported in Table 7. For each latent variable we took PCA result, that is we estimated the effect of the latent variable on the landscape evaluations, and simultaneously we are able to estimate α_r, the loadings of each indicators on the latent variable.

In the choice model we included the following explanatory variables: (a) socioeconomic variable (age and if individual is retired, level of income), (b) Group composition (couple, family and friends), (c) Residence (outside the city) and (d) perception of urban landscape. For the latent variable model (i.e. the perception) are included: (a) socioeconomic variable (age and education), (b) Group composition (couple, family and friends), (c) Residence (outside the city).

In Appendix 2 a summary statistics of the variables is reported, also for the indicators.

The estimation results of the choice model depicted in Figure 6 show that likelihood of spending for related goods and services is positively correlated with income and negatively with the age, although retired people are very likely to spend for related goods and services. As for the group composition we are currently not yet able to identify which groups are more likely to undertake complementary activities. People coming from outside the city are more likely to spend money.

By the implementation of the ICLV model, it stands out that positive territory perception affects the cultural visitors' spending. People who have a better perception of (a) Historic/traditional and (b) cultural sites are more likely to undertake activities in the city hosting the cultural event.

Combing the last two results, it is of main interest for governments and local institutions that cultural visitors, i.e. people coming from outside the city hosting the event, are more likely to undertake some complementary activities. Moreover people who have a better perception of the urban landscape and in particular who appreciate and have a good image of traditional and cultural sites, seems to be very likely then to use the city for recreational purposes. In fact people who have a good perception of the urban landscape, in addition to the cultural event, can generate additional economic transactions for related goods and services.

From the descriptive statistics (Figure 3) it has been shown that a relative low share of visitors do nothing in addition to the cultural event itself, i.e. only 28%. Many people who practice complementary activities, could be influenced in such a way to stay in the city. By promoting those points of interest who cause a better perception in individuals, may generate more willingness to invest time and money in undertaking activities in the city. In fact very often some sites such as cultural institutions are unknown to people coming from outside. For instance, Museo d'Arte (art museum), Museo delle Culture (museum of cultures), Chiesa Evangeliga (Church), as described in Figure 4, are poorly known. That means that many visitors ignore the existence of some point of interests that could influence their urban perception. If those sites who could make arise some positive sentiments in cultural people were more popular, it is very likely that more people will be predisposed to choose the city as a zone destination.

Table 5 Results: Choice model structural equation

	M1	M2	M3	M4	M5
Latent variable:	-	*Modern (F1)*	*Historic or traditional (F2)*	*Cultural (F3)*	*Nature-related (F4)*
Alternative constants					
β_No Choice	0.684 (0.438)	-0.0139 (0.720)	1.62* (0.838)	1.40 (0.963)	0.718 (0.984)
Parameters					
Socioeconomic variables					
β_Age	-0.0304*** (0.0102)	-0.0540*** (0.0145)	-0.0447*** (0.0124)	-0.0847*** (0.0194)	-0.0572*** (0.0139)
β_Retired	1.02*** (0.409)	1.27** (0.579	1.43*** (0.483)	2.36*** (0.657)	1.80*** (0.530)
β_Income	0.426*** (0.132)	0.476*** (0.177)	0.326** (0.157)	0.636*** (0.221)	0.470*** (0.175)
Group composition (reference: single)					
β_Couple	0.677*** (0.298)	0.688* (0.390)	0.633* (0.352)	0.588 (0.460)	0.491 (0.378)
β_Family	0.313 (0.325)	0.213 (0.440)	0.414 (0.390)	0.340 (0.513)	0.284 (0.425)
β_Friends	0.457 (0.322)	0.311 (0.429)	0.356 (0.391)	0.981* (0.521)	0.391 (0.408)
Residence (reference: in Lugano)					
β_Residence outside the city	0.467** (0.221)	0.478* (0.283)	0.610** (0.261)	0.712** (0.351)	0.569** (0.278)
Latent variables					
β_Urban landscape perception (Latent variable)	-	0.0493 (0.132)	0.367** (0.163)	0.526** (0.220)	0.218 (0.184)

Significance level: *** <1%; ** <5%; *<10%

Table 6 reports Latent Variable Model structural equations results. It is remarkable that socioecomic characteristics have in general a low explanatory power on the 4 latent variables (perceptions). With the exception of C3 (Cultural sites perception), in which age and education have a positive magnitude on the perception, which is consistent with cultural people. Age plays an important role also for C2 (historic/traditional sites perception).

The group composition does not have a clear effect on perceptions, even if people coming with the family seem to have negative impact on C4 (Nature-related sites perception). The same applies for people coming with friends, who have a negative marginal impact on C3. Also the residence is poorly significant in our sample, although it seems that people coming from outside, with respect to residents, have a negative marginal impact on C4. We are not yet able to identify explanatory variables for C1 (modern sites perception), it means that there are not statistically differences among different user groups.

Table 6 Results: Latent Variable Model structural Equation

	M1	M2	M3	M4	M5
Latent variable:	-	*Modern (C1)*	*Historic/ traditional (C2)*	*Cultural (C3)*	*Nature-related (C4)*
Dependent variable: Latent variable					
λ_Constant	-	3.53*** (0.476)	4.16*** (0.330)	2.60*** (0.432)	4.22*** (0.344)
λ_Age	-	0.00335 (0.00587)	0.00870** (0.00382)	0.0228*** (0.00507)	0.00435 (0.00396)
λ_Education	-	-0.160(*) (0.0964)	0.00955 (0.0641)	0.204*** (0.0836)	0.0888 (0.0683)
λ_Couple	-	0.0167 (0.249)	0.0726 (0.170)	0.00791 (0.225)	-0.137 (0.199)
λ_Family	-	0.0682 (0.286)	-0.145 (0.189)	-0.123 (0.255)	-0.372* (0.199)
λ_Friends	-	0.279 (0.278)	0.246 (0.193)	-0.555** (0.249)	0.0908 (0.197
λ_Residence outside the city	-	-0.0544 (0.190)	-0.117 (0.127)	-0.275(*) (0.172)	-0.224* (0.133)

Significance level: *** <1%; ** <5%; *<10%

Latent Variable Model measurement equations are shown in Table 7. For each latent variable we took PCA results. We estimated the effect of the latent variable on the landscape evaluations, and simultaneously we are able to estimate α_r, the loadings of each indicators on the latent variable. For Model 5 we included two additional sites, i.e. Villa Ciani and Funicolare Monte Brè, which are nature-related sites as well. The first one recall the city's park (Parco Ciani), while the second recall the definition of open space and natural environment as it is a funicular. All coefficients are statistically significant, therefore the latent variables can be measured by the chosen indicators. We included two more indicators with respect to what we found with the PCA only to have more indicators that can be representative of the latent variable.

Table 7 Results: Latent Variable Model measurement equation

	M1	M2	M3	M4	M5
Latent variable:	-	*Modern (F1)*	*Historic/ traditional (F2)*	*Cultural (F3)*	*Nature-related (F4)*
Effects of Latent Variables on Indicators					
Modern					
α_Centro Congressi	-	*fixed*	-	-	-
α_Pensilina degli autobus	-	0.917*** (0.0387)	-	-	-
α_Centro Esposizioni	-	0.821*** (0.0355)	-	-	-
α_Casinò di Lugano	-	0.601*** (0.0360)	-	-	-
α_Banca del Gottardo	-	0.934*** (0.0410)	-	-	-
α_Autosilo Balestra	-	0.844*** (0.0393)	-	-	-
Historic or traditional sites of the city					
α_Piazza Riforma	-	-	*fixed*	-	-
α_Villa Ciani	-	-	1.06*** (0.0187)	-	1.07*** (0.0232)
α_Funicolare Monte Brè	-	-	1.00*** (0.0193)	-	1.01*** (0.0230)
α_Portici di Via Nassa	-	-	0.996*** (0.0201)	-	-
Cultural sites					
α_Museo delle culture	-	-	-	*fixed*	-
α_Chiesa San Rocco	-	-	-	1.02*** (0.0301)	-
α_Museo d'Arte	-	-	-	1.00*** (0.0317)	-
α_Evangelica Riformata nel Sottoceneri	-	-	-	0.787*** (0.0324)	-
Nature/green spaces related sites					
α_Biblioteca cantonale	-	-	-	-	*fixed*
α_Lungo Fiume	-	-	-	-	0.974*** (0.0246)

Table 8 reports the Goodness of fit of our models, the number of observations, and the draws implied for the Maximum Simulated Likelihood Estimation. Rho bar squared is computed as

$$\rho^2 = 1 - \frac{LL(\beta^*)}{LL(0)}$$

where $L(0)$ is the initial log-likelihood and $L(\beta^*)$ is the final log-likelihood of the model, and it is a measure of goodness of fit. In general rho bar for hybrid choice models is higher than that for multinomial logit models, because of the improved performance by including the latent variable (Train, 2009) (Bierlaire, et al., 2011).

Table 8 Goodness of fit

	M1	M2	M3	M4	M5
	-	*Modern (F1)*	*Historic/ traditional (F2)*	*Cultural (F3)*	*Nature-related (F4)*
Goodness of fit					
Initial log-likelihood	-282.706	-6169.970	-4144.526	-2961.428	-3785.671
Final log-likelihood	-266.332	-3130.547	-2168.651	-1569.369	-1966.696
Rho bar	0.30	0.488	0.471	0.462	0.474
Sample size	408	250	299	198	262
Number of draws	-	*500*	*500*	*500*	*500*

The differences in sample sizes are due to the indicators included in the models, since very often people did not know the sites and therefore were not able to evaluate them.

The number of draws for the Maximum Simulated Likelihood Estimation are 500 for each model with latent variable. This number of draws led our estimates to converge on stable results, and with more draws the explanatory power of the model do not change.

4. Conclusion

The main research contribution of this work is the inclusion of latent variables in a choice model which intends to explain the determinants of spending decision for complementary activities of people attending cultural events. The focus of this work was to model audience decisions by simultaneously estimating a Latent Variable Model and a Discrete Choice Model, which takes into account for urban landscape perception. The drivers of this research effort are the need to study whether ancillary revenues generated by the cultural events can also be explained by a positive landscape perception.

Thanks to the PCA methodology, in our context, there are four main dimensions explaining the variability of the preferences, i.e. evaluation of modern/functional sites, historical or traditional sites, cultural sites and nature/green related spaces. By the simultaneous estimation of a Discrete Choice Model and Latent Variable Model; the findings suggest that people who have a more positive perception of the city, especially for historic/traditional and cultural sites are more likely to spend money for complementary activities.

These results show that positive territory perception affects directly the economic interactions that visitors of cultural institutions have with the urban context. In this way, improving urban landscape is an indirect but effective way for enhancing the economy of a city.

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Appendix 1: Known sites evaluation

Piazza Riforma

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Centro Congressi

☐ ☐ ☐ ☐ ☐ ☐ ☐

Cattedrale di San Lorenzo

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Museo delle Culture

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Pensilina degli autobus

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Villa Ciani

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Chiesa di San Rocco

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Centro Esposizioni

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Casinò

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Museo d'Arte / Malpensata

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Funicolare Monte Brè

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Biblioteca Cantonale

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Chiesa Evangelica

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Portici di Via Nassa

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Banca del San Gottardo

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Autosilo Balestra

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La Lanchetta

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Lungo-fiume / Cassarate

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Appendix 2: Descriptive statistics of variables

	Average	St.dev	Min	Max	Count	Missing
Choice (EXP)	0.44	0.50	0	1	422	0
Age	42.89	16.49	15	83	419	3
Retired	0.15	0.36	0	1	422	0
Income	2.80	1.80	1	7	412	10
Education	3.28	0.93	1	4	403	19
Couple	0.32	0.47	0	1	422	0
Family	0.23	0.42	0	1	422	0
Friends	0.23	0.42	0	1	422	0
Residence outside	0.60	0.49	0	1	422	0
Sites evaluations used as indicators						
Piazza Riforma	5.56	1.35	1	7	391	31
Centro Congressi	4.47	1.78	1	7	374	48
Museo delle culture	5.07	1.57	1	7	267	155
Pensilina dei bus	4.08	1.84	1	7	367	55
Villa Ciani	5.87	1.29	1	7	359	63
Chiesa San Rocco	5.19	1.55	1	7	311	111
Centro esposizioni	3.72	1.85	1	7	321	101
Casinò	3.02	2.03	1	7	328	94
Museo d'arte	5.18	1.59	1	7	292	130
Funicolare Mt. Brè	5.54	1.47	1	7	336	86
Biblioteca cantonale	5.55	1.48	1	7	304	118
Chiesa Evangelica	4.24	1.90	1	7	249	173
Colonne Via Nassa	5.54	1.50	1	7	370	52
Banca del Gottardo	4.19	1.90	1	7	319	103
Autosilo Balestra	3.82	1.97	1	7	355	67
Lungo fiume	5.35	1.48	1	7	364	58