Modeling Tourists' Personality in Recommender Systems

How Does Personality Influence Preferences for Tourist Attractions?

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ABSTRACT

Personalization is increasingly being perceived as an important factor for the effectiveness of Recommender Systems (RS). This is especially true in the tourism domain, where travelling comprises emotionally charged experiences, and therefore, the more about the tourist is known, better recommendations can be made. The inclusion of psychological aspects to generate recommendations, such as personality, is a growing trend in RS and they are being studied to provide more personalized approaches. However, although many studies on the psychology of tourism exist, studies on the prediction of tourist preferences based on their personality are limited. Therefore, we undertook a large-scale study in order to determine how the Big Five personality dimensions influence tourists' preferences for tourist attractions, gathering data from an online questionnaire, sent to Portuguese individuals from the academic sector and their respective relatives/friends (n=508). Using Exploratory and Confirmatory Factor Analysis, we extracted 11 main categories of tourist attractions and analyzed which personality dimensions were predictors (or not) of preferences for those tourist attractions. As a result, we propose the first model that relates the five personality dimensions with preferences for tourist attractions, which intends to offer a base for researchers of RS for tourism to automatically model tourist preferences based on their personality.

CCS CONCEPTS

• Information systems ~ Recommender systems • Human-centered computing ~ User centered design

KEYWORDS

Recommender Systems; Personality; Tourist Preferences; Affective Computing; Leisure Tourism

1 Introduction

Recommender Systems (RS) are being studied in various domains to help users make better choices [2; 70], being one widely studied the travel and tourism domain. Travelling is an emotional experience [14] and therefore, personalization is a key factor for the success of RS in tourism [21; 71; 73]. The more information about the tourist is known better recommendations can be made. Artificial Intelligence techniques, like Multi-Agent Systems, have been applied to RS to try to enhance the tourists' experience and proactively make suggestions based on the tourists' context and profile [3; 4; 8; 42]. To personalize agents

with the tourists' profile [53], to accompany them throughout the process by presenting intelligent information and proposing personalized challenges, according to the tourists' psychological aspects and interests, can improve their experience and satisfaction. For instance, personality has been shown to improve (group) recommendations and can even help with the cold-start problem [19; 75]. Studies show personality is strongly related to the users' preferences [75], and in the case of recommendations to groups, correlating the users' personalities and their preferences can help match users with similar interests, minimizing the groups' heterogeneity and conflicts of interest in (occasional) groups of tourists. Several studies exist on the relation between personality and tourist preferences, however, the ones available only focus on specific types of travelling or tourist roles [15; 17; 34; 46; 67; 74], or mainly target the Extraversion and Openness to Experience personality dimensions [5; 39]. So, what combination (if any) of personality dimensions influence the choice of certain tourist attractions?

In order to start overcoming those limitations, we engaged on a large-scale study to determine the relation between the Big Five personality dimensions and preferences for tourist attractions. First, an intensive research was conducted so that a questionnaire to collect as much information as possible about the respondents' personality, tourist and personal preferences, travel motivations and socio-demography could be constructed. The questionnaire was sent in a first round to Portuguese individuals from the academic sector and their respective relatives/friends, obtaining a sample of 508 valid responses. After analyzing and treating the responses, all personality dimensions were found to be predictors of different preferences for tourist attractions. As a result, we propose a model that relates all five personality dimensions with preferences for a wide range of tourist attractions, in the hope we can help researchers of RS for tourism to automatically model tourist preferences based on the tourists personality.

The remainder of the paper is structured as follows: Section 2 describes some related work on personalized Recommender Systems and Psychology of Tourism. Section 3 presents the methodology used, Section 4 the results and their respective analysis, along with the proposed models that relate Preferences for Tourist Attractions and how personality traits influence those preferences, and finally, Section 5 reflects on the contents addressed in the paper and describes what will be done as future work.

2 Background

2.1 Personality and Recommender Systems

Throughout the last two decades, personalization became the main concern for the effectiveness of RS [9; 68; 75; 78]. Therefore, to know personal information about the user is crucial for building a robust profile. The researchers increased interest in developing more personalized and accurate RS created the need to consider other research areas such as Psychology. Psychological aspects, such as personality, moods and emotions, are being perceived to influence the variance in the user preferences and behavior in RS

[76], and their consideration is evidencing to show better results than generic approaches [23; 57; 78]. Many personalized RS that take into account the users motivations [33], mood [13; 55], or personality [28; 62; 72; 77; 79] have been developed.

As defined by Eysenck [18], "personality is the sum-total of the actual or potential behavior-patterns of the organism, as determined by heredity and environment". Each individual has her own behavior patterns, which are considered relatively stable over time across different situations [48]. These patterns were summarized into five universal personality dimensions by Costa and MacCrae [12]: Openness to Experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, being the Five Factor Model (FFM), or Big Five, recognized as the most widely accepted model to represent them [16; 47]. Each factor is defined by six traits/facets [12], resulting in a total of 30 traits, which are more granular and can be used to better characterize a person (see Table 1).

Table 1: Personality dimensions and their respective six traits (adapted from Costa and MacCrae [12]).

Neuroti-cism	Extraver-sion	Openness to experience	Agreea-bleness	Conscien-tiousness
Anxiety	Friendliness	Imagination	Trust	Self-efficacy
Anger	Gregarious-ness	Artistic interests	Morality	Orderliness
Depression	Assertive-ness	Emotionality	Altruism	Dutifulness
Self-conscious-ness	Activity level	Adventurous-ness	Cooperation	Achievement-striving
Immode-ration	Excitement-seeking	Intellect	Modesty	Self-discipline
Vulnerabi-lity	Cheerfulness	Liberalism	Sympathy	Cautiousness

As noted by Tkalcic and Chen [75], personality can be useful in different areas of RS, since it is strongly related to the users' preferences [6]. Users with similar personalities tend to choose similar items or contents [7]. For example, extraverts who are dependent on warmth and gregariousness tend to enjoy popular music, and persons who score high on excitement seeking tend to enjoy rock music [7; 69]. In games, extraverts are more inclined to group activities than solo activities [81]. Even certain features of Instagram pictures are related to personality traits [20]. Personality is therefore a powerful characteristic of humans that can be used to help predict their preferences in a wide range of domains, but it is still an under explored topic in RS [6]. And how about the tourism domain? Is personality strongly (or weakly) related to tourist preferences, or only certain personality dimensions are? These are the research questions we propose to answer.

2.2 Psychology of Tourism

Research on psychology of tourism is rapidly growing, since it is evidenced that psychological aspects are related to the choice of specific destinations [32; 60; 64]. But which ones? Several researchers tried to answer that question, some by proposing tourist typologies based on psychological aspects, others by trying

to find relationships among personality traits and tourist behaviors or preferences.

2.2.1 Tourist Typologies. Cohen [10] was one of the first researchers to propose a tourist typology, composed of four types: the organized mass tourist (least adventurous, lazy, prefers package-tours, is more organized and prefers familiarity to novelty), the individual mass tourist (similar to organized mass but the tour is not fully preplanned, has a certain control over his time and itinerary and is not bound to a group), the explorer (trip self-arranged, likes to meet locals and speak their language without totally immersing herself), and the drifter (extremely independent, has no time schedules or itinerary, lives with the locals, likes novelty at maximum and familiarization at minimum).

Plog is another renown researcher who studied the psychology of travel in tourism [64]. He argued that travel destinations attract specific types of people [63] and proposed two main psychographic dimensions to characterize tourists' travel behavior: Allocentrics, who are more nature related, adventuresome, curious, like to explore the world around them, practical, outgoing, self-confident, seek for novelty and new experiences; and Psychocentrics, who are self-inhibited, anxious, non-adventuresome, prefer the familiar in travel destinations, especially if they can drive to them, and places where they can relax. The two dimensions are in the opposite extremes of a normally distributed continuum, being this scale later extended [65; 66]. Plog's model became widely known, and many researchers used or even tried to improve/extend it, some by correlating Plog's two dimensions with Extraversion [26; 31], activation theories [56], or sensation seeking, powerlessness and generalized anxiety [24]. However, no significant correlations to actual tourist behavior were found.

Jackson et al. [29] proposed four types of tourists: the explorer, the adventurer, the guided and the groupie, combining the orthogonal scales of Allocentrics-Psychocentrics and Introversion-Extraversion, model which was later studied by Jackson and Inbakaran [30]. As also suggested by Nickerson and Ellis [56], the authors found Extraversion and Allocentrism were independent constructs. The same cannot be said of Openness to Experience and Allocentrism, which showed to be correlated [30].

However, the existence of ambiguity between the dimensions of both Plog's and Jackson, White and White [29] models, led Eachus [17] to propose a modification to those typologies so a more objective measure of tourist preferences could be used: Adventurous preference, Beach preference, Cultural preference, and Indulgent preference. To do that, they used the Brief Sensation Seeking Scale (BSSS) [27] to predict their proposed Holiday Preferences Scale. They found that people with high sensation seeking values tend to prefer Adventurous and Beach holidays and not Indulgent holidays. No significant correlations were found between Sensation Seeking and Cultural holidays, but older people were more likely to prefer Cultural holidays than younger.

Based on the Cohen's individual mass tourist type [10], Wickens [80], proposed five micro-types of tourists according to a survey conducted in Chalkidiki (Greece): the Cultural Heritage type, who were more interested in the cultural, natural and historical aspects of the region; the Raver type, who were attracted

by sensual and hedonistic pleasures, prefer to spend more time at the beach and its night clubs; the Shirley Valentine type, who were seeking for a romantic experience with a "charming Greek gentleman"; the Heliolatrous type, who just wanted to relax and sunbath; and the Lord Byron type, who had the ritual to return every year to the same destination, because they enjoyed the familiarity, nostalgia and felt like home.

Interestingly, Gretzel, Mitsche, Hwang and Fesenmaier [23] proposed 12 travel personalities and found strong correlations between their respective activities. For instance, Shopping Sharks type was related to tourists more interested in shopping, nightlife, and dining.

2.2.2 Personality as Predictor of Tourist Preferences. However, and as pointed by several authors, the existing research on tourism behavior is mostly descriptive instead of predictive [29; 74] which is a limitation that needs to be overcome, i.e., what personality dimensions or traits are predictive of the tourists' typologies or behaviors/preferences found in literature? For example, some researchers focused on adventure tourism [1; 51], developing adventure tourism typologies such as "hard adventure" and "soft adventure" typologies [40]. Since most studies failed to determine the psychological antecedents of soft (e.g.: hiking, hunting, scuba diving) and hard (e.g.: climbing, cave exploring) adventure travelers [74], Schneider and Vogt [74] applied Mowen's [54] 3M Model of Motivation and Personality for consumer behavior, to explain the behavior of soft and hard adventure travelers. They found the interest in cultural experiences, need for arousal (excitement seeking) and need for material resources were predictors of hard adventure travel, and the interest in cultural experiences and competitiveness of soft adventure travel.

Li, Lu, Tsai and Yu [39] also studied the impact of sensation seeking and extraversion in the behavior of three types of tourists: familiarized mass tourists, organized mass tourists and independent tourists. They found extraversion did not significantly predict the tourists' behavior in neither of the three types, but sensation seeking did, being the highest level for independent tourists, followed by organized mass tourists and then familiarized mass tourists. They also concluded extraversion and sensation seeking were measuring different things.

Kvasova [37] studied how personality influences tourists' eco-friendly behavior. No association between Extraversion and eco-friendliness was found, but individuals with high Agreeableness were strongly related to eco-friendly behavior, followed by Conscientiousness and Neuroticism, confirming several past studies on the same area of research [25; 44; 50]. Regarding Openness to Experience, individuals with high imagination were negatively associated to eco-friendliness but individuals with high intellect were positively associated.

A study on how Extraversion and Openness to Experience influenced the tourists satisfaction with a set of different tourist experiences was performed by Bujisic, Bilgihan and Smith [5]. Results showed that individuals with higher level of Openness to Experience tended to be more satisfied with aesthetic and escapist experiences than those with lower level. In contrast, individuals with lower Openness to Experience were more satisfied with entertainment and educational experiences compared to the ones

with higher level. Extroverts tended to be more satisfied with educational and escapist experiences.

More recently, Poon and Huang [67] used Plog's psychographic model [66] to study how travel personality affected peer-to-peer accommodation ("couch-surfing") preferences in the AirBnB platform. They found Allocentrics (adventurous and risk-taking) who travelled alone, with partner, or with friends, were more prone to use AirBnB than Psychocentrics, or Allocentrics when travelling with family.

Masiero, Qiu and Zoltan [46], beside other factors, studied how personality could influence long-haul tourists to visit a stopover destination. For measuring personality they used the BSSS [27] and concluded sensation seekers were more inclined to stopover visits. Also, travelers more interested in entertainment (shopping, casinos, cinemas, theme parks, theater, etc.), nature (seascape, coasts, islands, beaches, landscapes, parks, mountains, flora and fauna), and cultural (historical/archaeological sites, museums, architecture and industrial sites, city sightseeing) attractions were more prone to a first-time visit to a stopover destination, contrary to tourists with preference for sport activities who were less likely to visit a stopover destination.

Although many studies on psychology of tourism for different sectors can be found, many are about typologies of tourists, which as mentioned before, are descriptive of the tourists' behavior and do not predict how that behavior impacts the choice of tourist preferences. Others try to predict how psychological aspects influence tourist behavior or preferences, but most of them only rely on Sensation Seeking and/or Extraversion scales, which do not cover all Big Five's dimensions. Few studies try to correlate all Big Five dimensions to tourist behaviors or preferences [36; 37], being the works of Delic, Neidhardt and Werthner [15] and Jani [34] worth mentioning, where they studied how the Big Five correlated to a variety of tourist roles. For example, Sun Lover type was related to high neuroticism individuals, Archeologist to extraverts, and Drifter to less conscious people [15]. However, none, to the best of our knowledge correlates the five personality factors to the choice of a wide range of specific tourist attractions. With this work, we intend fill that gap by proposing a model to predict the preference for a wide range of tourist attractions based on the tourists' five personality dimensions. This research is motivated by the evidences found in literature, from which it is possible to deduce that the tourist typologies do not fully match the tourists' preferences for tourist attractions, since many different combinations of intensity for the personality traits exist and therefore a single typology may not be enough for a certain tourist as well as not all the attractions present in a typology may be suitable for that tourist. This is supported by the results found by Gretzel, Mitsche, Hwang and Fesenmaier [23].

3 Methodology

In order to investigate how personality dimensions impact the choice of tourist attractions, we first studied the terms used for classifying the most significant tourist attractions. As defined by Lew [38] "tourist attractions consist of all those elements of a "nonhome" place that draw discretionary travelers away from

their homes. They usually include landscapes to observe, activities to participate in, and experiences to remember." To be considered an attraction, a phenomenon must have three components: "a tourist, a site to be viewed and a marker or image that makes the site significant" [43]. Based on these definitions and the categorizations of attractions by Lew [38], the "Thesaurus on Tourism and Leisure Activities" [59] and Moreno et al. [52], we selected the most common tourist attractions terms.

An online questionnaire comprised of five sections was then built, which asked about socio-demographic data (26 items), personality characteristics, personal preferences and concerns when travelling (34 items), travel motivations (adapted from Pearce and Lee [61], with 28 items), and preferences for tourist attractions when going for an ideal vacation destination (since Litvin [41] showed questioning for the ideal vacation destination matched the traveler personality). The preferences for tourist attractions were based on the previously selected attractions (68 items). Responses to the three last sections were measured using a 7-point Likert scale. The personality was measured using one of the most widely spread personality inventories: Big Five Inventory (BFI, 44-item), which assesses an individual on the Goldberg's [22] Big Five dimensions of personality, using a 5-point Likert scale. All responses were mandatory, except the sensitive questions (sexual orientation, religion, health issues) in the socio-demographic section. Control questions in sections 2 to 5 were used to verify the consistency of the responses.

A pilot study with 46 respondents was then conducted in order to test its readability, comprehension, and validity. After some modifications, the final version of the questionnaire accounted for 196 questions.

Using the snowball sample method, the questionnaire was disseminated, in several waves, via email to various mailing lists of academic institutions in the North of Portugal, including professors, scholars (including this paper own authors) and general employees, which were asked to share the questionnaire with their respective relatives/friends. Participants were asked to respond as honestly and truthfully as possible throughout the various sections as if they were actually setting up their profile in a tourism application (e.g.: Booking.com or TripAdvisor) for a proposal of a travel itinerary according to their interests. Although the questionnaire is still ongoing for a larger study, responses were collected for 4 months, from October 2019 to January 2020, gathering a total of n=508 viable responses.

4 Questionnaire Results and Analysis

4.1 Sample Description

As can be observed in Table 2, the sample is characterized by a greater percentage of female respondents (68%), being most of the respondents between 18-55 years old, existing a similar percentage between respondents bellow 25 years, and between 25-39 years (38% and 34%, respectively). The mean age is 33 ± 13 years, since most respondents were from academic institutions, which is also reflected in the great majority of respondents having a higher education level (74%). From the 508 respondents, 23% had already lived in other countries, showing almost one third of the sample

had the experience of interacting with other cultures. The marital status of the sample was balanced, showing 53% were on some sort of a relationship, and the other 47% were single or separated. The formation area of the majority reflects the academic institutions to which the questionnaire was sent, being more than half (54%) from "Exact and Engineering Sciences" and 26% from "Social Sciences and Humanities". Has for travelling data, by far the great majority had already visited 3 or more countries in their life (96%), but per year, 79% of the respondents travelled 3 times or less. When in leisure, most of the sample (97%) travels accompanied, which may reflect the majority of respondents being young adults.

Table 2: Sample descriptive statistics (n=508).

		n	*%*
	< 25	194	38
Age	25-39	171	34
	40-54	105	21
	>55	38	7
Sex	Female	347	68
	Male	161	32
Lived in other Countries	Yes	119	23
	No	389	77
	Divorced/Separated	22	4
Marital Status	Married	131	26
	Non-marital partnership	36	7
	In a relationship	100	20
	Single	219	43
Have children	No	349	69
	Yes	159	31
Higher education	No	131	26
	Yes	377	74
	Exact and Engineering Sciences	273	54
Formation area	Social Sciences and Humanities	132	26
	Life and Health Sciences	41	8
	Other	62	12

4.2 Tourist Attractions Preferences

Using IBM® SPSS® Statistics version 26, an Exploratory Factor Analysis (EFA) was performed on the 68 items related to the preferences for tourist attractions by using the principal components extraction method with Varimax rotation and with Keiser normalization (eigenvalue > 1), suppressing coefficients bellow 0.40[1]. Thirteen factors were extracted, most of them aggregating items of the same concepts as expected, but some were scoring with only one item and therefore were eliminated. EFA was run again and factors with low reliability (i.e., Cronbach's Alpha α < 0.70) were removed[2], meaning the sample was not heterogeneous enough to measure those items. A final EFA was run resulting in 11 factors, explaining 68% of the total variance, all with a good Cronbach's Alpha reliability, meaning the items on each factor were measuring the same concepts. Names for each

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[1] This resulted in the elimination of 11 items: A2-Watch natural phenomena, A3-Religious celebrations, A16-Popular celebrations, A19-Botanical gardens, A23-enjoy/buy handicrafts, A25-Funfairs, A30-Picnics, A31-Shopping, A52-City parks, A54-Safaris, A57-Horse riding.

[2] This resulted in the elimination of items scoring alone or factors with α < 0.70: F6A5-Oceanarium, F4A21-Beaches natural beauty, F11A24-Biking, F13(A38-Impactful constructions, A39-Thematic parades), F12(A58-Hunt/Fishing, A60-Bullfights, A61-Circus), F10A62-Cruise.

factor were assigned according to the concepts they represented: F1-Adventure; F2-Nature; F3-Entertainment & Nightlife; F4-Sun, Water & Sand; F5-Museums & Landscapes; F6-Themes & Animal Parks; F7-Cultural Heritage; F8-Sports & Games; F9-Gastronomy; F10-Boat Tours; F11-Health & Well-being (see Table 3). The reliability for the entire scale was very good (α = 0.914) which confirmed the items in the scale were all related to the same concepts.

The next step was to conduct a Confirmatory Factor Analysis (CFA), using IBM® SPSS® AMOS version 26, to create the first order model to confirm if the observed variables (Attractions) saturated the latent variables, i.e., the extracted factors (Tourist Attractions Preference) and what correlations exist between the 11 factors. For the estimation, the maximum likelihood method was applied. Several adjustments were needed to reach an acceptable fit of the model, such as eliminating four items with a regression weight lower than 0.5 [45], and correlating errors within the same factors as suggested by the modification indexes, resulting in a final scale with a total of 48 items (see Table 3). All factors regression weights were statistically significant in the prediction of their respective items for p < 0,001*** (two-tailed). The model revealed an acceptable goodness of fit (χ^2/df=3.046; CFI= 0.828; GFI= 0.787; PCFI= 0.737, PGFI= 0.672, RMSEA= 0.064; p[rmsea≤0.05]p< 0.001), suggesting that the items provide a satisfactory fit for the proposed model (see Figure 1) [45].

4.3 Personality and Tourist Attractions Preferences

In order to answer the research questions of this study, several other steps were needed. First, the scores for each personality dimension were calculated according to the BFI scoring table [35]. As can be seen in Table 4, the average scores for each personality dimension was similar, corresponding to the middle of the respective score range, which means most of the participants responded in average "3-Neither agree nor disagree". These observations are better reflected in Figure 3, where in all five dimensions, albeit with different asymmetries, there is a clear concentration of results in the average scores of the scale. A clear majority of participants show moderate values in the Extraversion and Neuroticism dimensions, but in the Agreeableness, Conscientiousness and Openness scores distribution the graphics show a higher kurtosis, i.e., there is a slighter deviation in the scores, where the participants classified themselves more between 3-Neither agree nor disagree and 5-Agree strongly. This higher concentration above mid-point scores may be reflecting some social desirability bias, which is conceivably more pronounced due to self-reporting answers to items that convey the idea of kindness and morality in the case of Agreeableness; self-efficacy, truthfulness and effortful workers/students in the case of Conscientiousness; and probably intellect in the case of Openness to Experience.
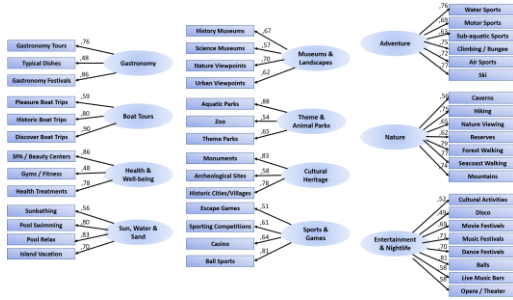
Figure 1: Confirmatory Factor Analysis of the Tourist Attractions Preference model obtained with the Exploratory Factor Analysis procedures, showing the normalized regression weights for each item (simplified model, disturbances and covariances omitted).

The BFI responses to the 44 items were then used to predict preferences for the previously proposed tourist attractions, using Structural Equation Modeling and CFA, applying the maximum likelihood method for estimation. This resulted in our proposed model of "Personality-Tourist Attractions Preference" as shown in Figure 2. Although with lower values, the combination of the indicators reveal an acceptable goodness of fit (χ2/df= 2.486; CFI= 0.712; GFI= 0.680; PCFI= 0.676, PGFI= 0.632, RMSEA= 0.054; p[rmsea≤0.05]p< 0.001), suggesting that the items provide a satisfactory fit [45], thus confirming the proposed "Personality-Tourist Attractions Preference" model.
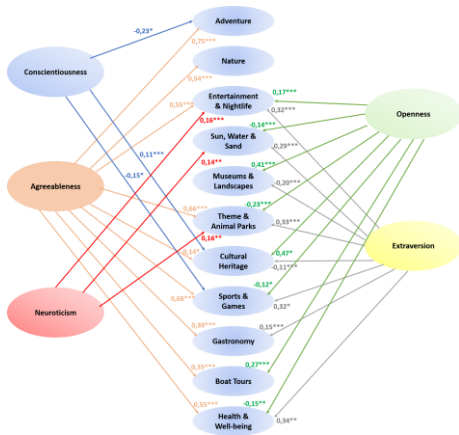

Figure 2: Simplified Structural Equation Model for the proposed "Personality-Tourist Attractions Preference" model. For readability, only the statistically significant values are presented (* p < 0.05 (2-tailed), ** p < 0.01 (2-tailed), *** p < 0.001 (2-tailed)).

By analyzing the model, interesting predictions were found. Individuals with a higher preference for Adventure tend to score higher on Agreeableness but lower on Conscientiousness. This goes in line with evidences found in literature, where less conscientious people tend to enjoy risky activities [15; 17; 74]. Looking at the personality traits described by Costa Jr et al. [11], this correlation suggests spontaneous individuals get along easily with others.

A higher preference for Nature-related attractions is positively predicted by higher Agreeableness. These individuals tend to be

more sympathetic, considerate and altruistic, this may correspond to more concerned and attracted to nature individuals, which may be somehow related to the ecological concern of highly agreeable persons as found by Kvasova [37].

Table 3: Varimax rotated component matrix for the proposed tourist attractions, showing the 11 factors extracted using EFA, the estimated correlations between the items and factors, and each factors Cronbach's Alpha reliability.

Factor	Item	Description	Estimated correlations	α
Adventure F1	A46	Practice climbing or bungee jumping	0,775	0.876
	A63	Do air sports (e.g., parachute jump, skydiving, gliding)	0,758	
	A68	Ski	0,750	
	A12	Practice aquatic sports (e.g., sailing, canoeing, diving, jet skiing)	0,744	
	A29	Do motorsports (e.g., karting, motocross)	0,627	
	A37	Observe sub-aquatic environments / marine life (e.g., snorkeling, submarine)	0,575	
Nature F2	A41	Walk in the forest / woods	0,821	0.857
	A11	Do hiking / mountaineering	0,721	
	A42	Take a walk along the river / seacoast	0,662	
	A47	Visit mountain areas / gorges	0,635	
	A36	Visit nature or wildlife reserves	0,632	
	A10	Appreciate natural landscapes	0,625	
	A6	Visit caves/caverns/volcanoes	0,523	
Entertainment & Nightlife F3	A44	Go to a dance/ballet festival	0,823	0.849
	A43	Go to a music festival/concert	0,743	
	A45	Go to balls (dancing)	0,722	
	A48	Go to a live music bar/place	0,683	
	A17	Go to a film festival	0,624	
	A67	Assist to an opera/theater	0,621	
	A8	Attend cultural activities / artistic performances	0,512	
	A9	Go to the disco/nightclub	0,473	
Sun, Water & Sand F4	A65	Go to the swimming pool to relax	0,797	0.807
	A22	Go to the beach (sunbathing/ swimming)	0,725	
	A66	Have vacation on an island	0,648	
	A64	Go to the swimming pool to swim/dive	0,642	
Museums & Landscapes F5	A32	Visit museums of historical themes	0,741	0.775
	A34	Visit viewpoints of natural landscape	0,731	
	A33	Visit museums of scientific themes (e.g., planetarium, paleontology)	0,670	
	A35	Visit viewpoints of urban landscape	0,637	
Themes & Animal Parks F6	A15	Go to a Zoo	0,821	0.736
	A13	Go to a theme park (e.g., Disneyland Paris)	0,641	
	A27	Go to a water park	0,590	
Cultural Heritage F7	A7	Visit archaeological sites / ruins	0,737	0.763
	A20	Visit monuments (e.g. churches, cathedrals, castles, fortresses, monasteries, palaces, etc.)	0,720	
	A4	Visit the historic cities/villages of the destination	0,657	
Sports & Games F8	A56	Assist to a sporting competition (e.g., watch a football game from a club of that country)	0,764	0.723
	A55	Play at the casino	0,638	
	A53	Play ball sports (e.g., football, handball, volleyball, tennis)	0,601	
	A59	Participate in an escape game	0,572	
Gastronomy F9	A1	Go to a Gastronomy Festival (food and/or drinks)	0,844	0.742
	A40	Participate in a gastronomy tour (typical and/or gourmet dishes, wine tasting)	0,772	
	A18	Taste typical local dishes	0,674	
Boat Tours F10	A51	Take boat trips for the pleasure of boating	0,626	0.790
	A49	Take boat trips to know the destination's coast	0,619	
	A50	Take boat trips for the historical value of the route	0,555	
Health & Well-being F11	A28	Go to a SPA / beauty center	0,582	0.733
	A14	Undergo health and wellness treatments (e.g., hydrotherapy centers, mineral water resorts)	0,575	
	A26	Attend gyms / fitness centers	0,556	

Entertainment and Nightlife activities are positively associated to all personality dimensions except Conscientiousness. One can presume almost everyone enjoys some form of entertainment or outings, but, once again, there is some risk avoidance as well as a sense of frugality related to conscientious persons that does not seem to combine with futile spending and/or unhealthy habits.
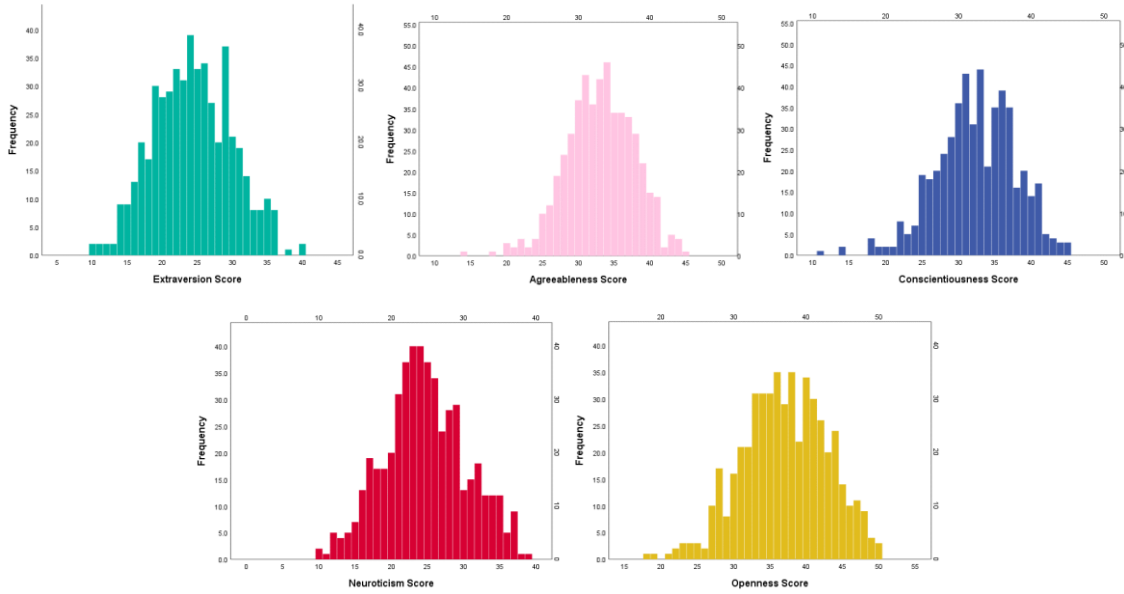
Figure 3: Distribution of the five personality dimensions scores among the sample.

Table 4: Personality dimensions mean total scores (BFI-44), n=508.

	Mean	SD	Min/Min range	Max/Max range
Extraversion	24	6	10/8	40/40
Agreeableness	33	5	14/9	45/45
Conscientiousness	32	5	11/9	45/45
Neuroticism	25	6	10/8	39/40
Openness	37	6	18/10	50/50

Activities like going to the beach or a swimming pool are strongly related to more extraverted, open to experience and neurotic individuals, as also found by Delic, Neidhardt and Werthner [15]. Extraverts may appreciate the opportunity to be in contact with other people, both new and known acquaintances, and at the same time feel comfortable with their body-image. Individuals with high openness may enjoy the aesthetic experience that comes with appreciating a beach for its natural beauty, along with the meditative state this surroundings may induce, confirming the results found by Bujisic, Bilgihan and Smith [5]. In turn, neurotics may appreciate these activities for consisting in somewhat predictable vacations, almost a default option in the context of our country, thus reassuring a strong sense of safety and control which is dear to these individuals.

Visiting museums and landscape viewing are preferred by more open to experience individuals, while extraverted are negatively associated. This goes in line with the findings of Bujisic, Bilgihan and Smith [5] and Jani [34]. Sense can also be made in light of the fact that enjoying historical artifacts or pursuing intimate experiences commonly brought by absorbing impactful sceneries are activities more akin to individual enjoyment and solitude.

The preference for visiting Theme and Animal Parks is positively predicted by persons with higher Agreeableness (probably related to the ones who get along with the ones who enjoy those activities, such as children and adolescents), Neuroticism (the same as the agreeable interpretation) and Extraversion (related to energetic and excitement seeking persons). The preference for Theme and Animal Parks is negatively predicted by Openness to experience, possibly for its standardized, not-so-intellectually-challenging nature. No significant prediction was found for Conscientiousness.

Archeological sites/ruins, monuments and historic cities/villages are also positively sought by agreeable, conscientious and open to experience individuals, but negatively by extraverts, who may not find very exciting that sort of activities as they are averse to sedentarism, confirming the results found by Jani [34], but contradictory to the results found by Delic, Neidhardt and Werthner [15]. This contradiction can be due to the different cultures studied or the sample size, although other reasons can be the cause.

Sports and games are negatively associated to conscientious and open to experience individuals, but agreeableness and extraversion are positively related, which can derive from the cooperativeness, energy, and high activity level inherent to these activities. This confirms what was found for Adventure preferences, and the findings of Schneider and Vogt [74], who found competitiveness was associated to soft adventure travelers.

Gastronomy experiences are positively valued by more agreeable and extraverted people, which can explain why who appreciates food and wine is usually seen as cheerful and high-spirited. No significant relations were found for the other three personality traits.

Boat tours are preferred by individuals with higher agreeableness and openness to experience, being in line with the results found by Jani [34], which is similar to the interpretation given for beach/swimming pool activities and landscape viewing.

Health and well-being are valued by those with higher Agreeableness and Extraversion, but with lower Openness. No significant association was found to Conscientiousness and Neuroticism, which does not mean they do not exist.

The results found demonstrate a strong relation between the five personality dimensions and preferences for tourist attractions, i.e., preferences for specific tourist attractions can be predicted by the tourists' personality meaning they can be used in RS for tourism to automatically model the users preferences.

5   Reflections and Future Work

In the domain of travel and tourism, little information is known about the prediction of tourist preferences based on the tourists' personality. This work brought new insights, successfully and strongly relating all the Big Five personality dimensions to preferences for specific tourist attractions, showing all the extracted tourist attractions factors are relevant and could be predicted by the personality dimensions, constituting, to the best of our knowledge, the first "Personality-Tourist Attractions Preference" model in literature to do so.

Although the model was confirmed with a satisfactory fit, and since this study is part of an ongoing larger study, we believe the model's fit will considerably improve with the increase in size and heterogeneity of the sample, provided the used sample was small for the number of variables to estimate.

It was also found that due to the self-reporting answers in the BFI, some personality dimensions had a higher concentration above mid-point scores, which may reflect some social desirability bias, or that the sample should be more diverse. In fact, most of the respondents had a higher education level, which can explain the greater frequency of higher scores in dimensions like Openness to Experience and Conscientiousness, meaning this study is limited in predicting tourist attractions preferences for individuals with lower education. Also, most respondents were from Exact or Social sciences, meaning the sample was poor on other fields of education, which can also account for the lower variability found in Openness to Experience, Conscientiousness and Agreeableness, since, for instance, individuals with Artistic formation would supposedly positively influence the Openness to Experience overall score.

Also, we cannot forget the questionnaire was conducted in a Portuguese population, and therefore some relationships found between personality and tourist attractions can be culture specific. However, our intention is to conduct the same study on different cultures and compare the results.

Although personality revealed to be a great predictor of tourist preferences, to focus only on the five personality dimensions and not on the more granular thirty traits and on the correlations between them, may limit the preferences prediction. For example, a person considered extraverted may not be a risk taker or like adrenaline-filled activities. It would not be very good if the RS suggested a rollercoaster to the tourist. Since the questionnaire allowed to obtain significant data, it will be further analyzed, along with the incoming data, to determine which of the 30 personality traits can be inferred from the BFI.

It is also evidenced that the personality structure varies substantially across cultures [48], and that certain personality traits are more lean to show different emotions according to the social context they are in [58]. Therefore, to know the personality is not enough, all these variables need to be correlated to provide higher quality recommendations and a greater user experience.

Other psychological aspects, such as mood, intentions, emotions, and motivations have also shown to influence the tourists' preferences [58; 76]. Therefore, other psychological aspects will also be a focus in our future work.

It is important to refer that, in addition to psychological factors, other factors, like the geographic and cultural distance should be included in the studies of the relationship between the tourists' personality and destination choice [49; 67].

It is quite evident that personality is not the only responsible for tourist preferences, but it seems undeniable that personality plays an important role in the kind of tourist attractions one chooses to visit.

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