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Does personality predict traveling abroad as indicated by mobile phone data? The idea of the mobile personality revisited

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ABSTRACT

The present study examines the associations between the Five-Factor Model personality traits and the trips abroad over a period of 12 months in a sample of 349 adults by using Call Detail Records. Our findings show that the modern-day traveler is likely younger, open to new values (O6) and experiences (O4) and seeking novelty and excitement (E5). Higher Extraversion, especially higher levels of social dominance (E3) and energy (E4), and higher spontaneity (C6) also play a role in predicting how often people travel abroad and how many different countries they visit. Our findings indicate the importance of studying personality at a more fine-grained level and cautiously support the notion of the "mobile personality."

1. Introduction

> *Of the gladdest moments in human life, methinks, is the departure upon a distant journey into unknown lands. Shaking off with one mighty effort the fetters of Habit, the leaden weight of Routine, the cloak of many Cares and the slavery of Home, man feels once more happy. /…./ A journey, in fact, appeals to Imagination, to Memory, to Hope,—the three sister Graces of our moral being.*
> Sir Richard Francis Burton (1872), *Zanzibar*, Vol. 1, pp. 16–17

The quest for traveling is often said to be as old as humankind itself (Leed, 1991), with travel being "at the source of the human experience" and "one of the most elemental activities, almost as basic as the act of breathing" (Monga, 1996, p. 6). Exploring different cultures and traveling abroad, which was once an experience reserved for a rather limited group of people—be it great voyagers, merchants, pilgrims, missionaries, or young aristocrats—has become a common activity enjoyed by many. Before the outbreak of the global COVID-19 pandemic, traveling abroad was growing steadily in recent decades all over the world, with international tourist arrivals reaching the 1.5 billion mark in 2019 (United Nations World Tourism Organization, 2020). Just to put things into perspective, in 2019, Europe accounted for 51% of the world's international arrivals (742 million), which is more than the total number of international visits (623 million) made across the globe twenty years earlier (World Bank Database, 2020). People travel for different reasons, but predominantly for leisure and holidays (56%), visiting friends and relatives or for religious and health purposes (27%), and for business and work (13%) (United Nations World Tourism Organization, 2019).[1]

The surge in international travel has been explained by an increase in disposable income (i.e., growing income levels make traveling affordable for more people) and global aging (more and more people are traveling in their older age, including for medical reasons), as well as increasing connectivity and creating new routes and destinations (Visa, 2016). And yet, not all people are equally willing to undertake foreign travel, and, exactly for this reason, there has been a growing interest in examining and understanding the so-called "mobile" or "migrant" personality (Boneva & Frieze, 2001; Frieze & Li, 2010). In other words, are there some special personality traits that make people more likely to travel abroad, either short-term or long-term, regardless of the reason? The present study contributes to this growing field of research by

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[1] The UNWTO data show that the outbreak of the COVID-19 pandemic in Spring 2020 resulted in an 85 percent fall in the number of international tourist arrivals in the first five months of 2021 when compared to the same period of 2019 (United Nations World Tourism Organization, 2021). However, international tourism is expected to gradually recover in 2022 as the pandemic recedes and many countries are dropping their Covid-19 entry rules and other public-health restrictions (United Nations World Tourism Organization, 2022).

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examining the role of the Five-Factor Model (FFM) personality traits in predicting travel abroad during a 12-month period using mobile roaming call detail records (CDR).

1.1. The "Mobile/Migrant" personality

The character and personality traits of great travelers and explorers have fascinated historians, writers, and the public alike for centuries (e.g., Beaglehole, 1956; Samwell, 1786; Wright, 1906). So, the idea of some people being more prone to move around and visit new places than others is certainly not new, and can be dated back a lot earlier than 1970 s when Jennings's (1970) concept of the "mobicentric man", the idea of the "pioneering personality" (Morrison & Wheeler, 1976), and Plog's (1974) theory of the traveler personality type were introduced. People with a mobile or migrant personality are believed to be "predisposed" to travel and be open to cross-cultural experience, which results in moving from one country to another, or simply in frequent travels abroad, either for leisure or work-related reasons (Boneva & Frieze, 2001; Frieze & Li, 2010).

Early studies on the migrant personality often focused on achievement motivation, which was found to be a significant predictor of mobility or mobility intentions among different population groups, such as Japanese and Korean immigrants to the United States, or Jamaicans (Caudill & de Vos, 1956; DeVos, 1983; Tidrick, 1971). Later research on American students has confirmed that those who either desire studying abroad (Li, Olson, & Frieze, 2013), or have already done so (Schroth & McCormack, 2000), have higher levels of achievement motivation than those who have no such plans.

More recent research on the associations between personality characteristics and mobility has mostly focused on examining the role of the FFM personality traits in predicting and explaining individual differences in people's attitudes toward migrating or moving from one place to another. The FFM of personality, which proposes Neuroticism, Extraversion, Openness to Experience (Openness), Agreeableness, and Conscientiousness as the main factors in personality differences, each including a number of more specific facets, has been shown to have a substantial genetic basis (Vukasović & Bratko, 2015) and be generalizable across languages and cultures (Allik & Realo, 2017; Allik, Realo, & McCrae, 2013). The findings of studies conducted in Estonia, Lithuania, and New Zealand have shown that higher Openness increased, whereas higher Conscientiousness and Agreeableness decreased, the chances of a participant's intentions to move abroad when different social, cultural, and sociodemographic factors were accounted for (Paulauskaite, Šeibokaitė, & Endriulaitienė, 2010; Pungas, Täht, Realo, & Tammaru, 2015; Tabor, Milfont, & Ward, 2015).

Even though intentions to move are the strongest predictor of an actual move, they do not always result in an actual move for a wide range of reasons (De Groot, Mulder, & Manting, 2011). However, a number of studies from Finland, Italy, Sweden, and United States has shown that higher Extraversion and Openness and lower Agreeableness and Neuroticism are indeed strong predictors, not only of people's migration intentions, but also of them actually moving from one place to another, both within and between countries (Camperio Ciani, Capiluppi, Veronese, & Sartori, 2007; Jokela, 2009; Jokela, Elovainio, Kivimäki, & Keltikangas-Järvinen, 2008; Silventoinen et al., 2008). Interestingly, higher levels of sociability (a proxy to Extraversion) and emotional stability (opposite to Neuroticism) predicted not only migration propensity, but also longer migration distances (Jokela et al., 2008).

All the studies reviewed above have examined people's intentions to migrate or their actual move within their country or to another country. However, very few studies that we are aware of have examined the relationships between the FFM personality traits and temporary international mobility—sojourning—such as traveling abroad for leisure, work, study, or other reasons. It has been suggested that people who travel for tourism or other purposes share characteristics with people who relocate to another country on a more permanent basis (Bell & Ward, 2000; Frieze & Li, 2010), but the empirical evidence is rather scarce and not conclusive. For instance, higher levels of Extraversion predicted both short-term (one semester) and long-term (one academic year) studying abroad in a sample of German university students, whereas higher Conscientiousness predicted only short-term, and higher Openness long-term, sojourning, when all other traits were controlled for. However, all the studies we are aware of (see also Lüdtke, Roberts, Trautwein, & Nagy, 2011) have focused on a specific group of population of a similar age (i.e., high-school and university students) and mostly on a specific reason for traveling abroad (i.e., for studying abroad), so it is not known if, and to what extent, the findings of these studies can be generalized to a wider population from diverse socioeconomic backgrounds, as well as with a range of different motives and reasons for traveling abroad.

1.2. The aims of the present study

The present study aims to add to the existing literature by examining the associations between the FFM personality traits and trips abroad over a period of 12 months in a sample of Estonian adults. More specifically, we first aim to examine if the FFM personality traits allow us to predict whether people have travelled abroad or not. The second aim of the study is to find out whether the FFM personality traits are significantly related to the frequency and length of trips abroad, the number of countries visited, and the longest distance travelled. Based on previous studies that have demonstrated the importance of gender, age, and education level in personality traits (e.g., McCrae et al., 2004; Schmitt, Realo, Voracek, & Allik, 2008) and spatial mobility (e.g., Bell & Ward, 1998, 2000; Masso, Silm, & Ahas, 2019), we control for these demographic variables in all our analyses.

Differently from the previous studies reviewed above, participants' travel records over the study period were obtained by analyzing their use of mobile phones abroad. With the increased rate of mobile phone use, data collected via mobile phones have become increasingly popular over the last decade in studying people's social behavior (see Harari et al., 2016 for a review). Mobile and smartphone data are also being increasingly used to predict personality (e.g., Chittaranjan, Blom, & Gatica-Perez, 2013; de Montjoye, Quoidbach, Robic, & Pentland, 2013; Mønsted, Mollgaard, & Mathiesen, 2018; Stachl et al., 2020), while other studies have focused on predicting people's daily spatial behavior (Ai, Liu, & Zhao, 2019) or smartphone usage (Stachl et al., 2017) from their personality traits.

In the current study, we use the FFM personality domains and facets to predict people's trips abroad and related characteristics, such as the number, length, and distance of cross-border trips across a period of 12 months using outbound roaming Call Detail Records (CDR), i.e., outgoing calls, incoming calls, and outgoing text messages while abroad. CDR has been successfully used to analyze people's short- and long-term spatial behavior, including within-country residential changes (Kamenjuk, Aasa, & Sellin, 2017) and seasonal migration patterns (Silm & Ahas, 2010), whereas the inclusion of roaming data has been effectively applied to examining cross-border mobility and tourism patterns (e.g., Ahas, Silm, & Tiru, 2017; Masso et al., 2019; Mooses, Silm, Tammaru, & Saluveer, 2020; Saluveer et al., 2020; Silm, Jauhiainen, Raun, & Tiru, 2021).

Following earlier studies, we hypothesize that, when controlled for age, gender, and education—.

(1) higher levels of Openness and Extraversion significantly predict whether participants travelled abroad during the study period (Hypothesis 1);
(2) people who score higher on Openness and Extraversion made more frequent trips abroad (Hypothesis 2);
(3) people with lower scores on Agreeableness and Conscientiousness spent more days abroad (Hypothesis 3);
(4) higher Openness is significantly related to a higher number of countries visited during the study period (Hypothesis 4); and

(5) people with lower levels of Neuroticism and higher levels of Extraversion travelled longer distances when abroad (Hypothesis 5).

As mentioned in the Introduction, all studies so far have examined associations between intentions to move or actual move and the FFM personality domains. In this study, we offer a more nuanced description of the "travelers' personality profile" by additionally examining narrower facets that lie beneath the broad FFM factors in the personality hierarchy that have been shown to be instrumental in understanding and predicting social behavior and life outcomes (e.g., Mõttus, 2016; Paunonen & Ashton, 2001; Paunonen, Haddock, Forsterling, & Keinonen, 2003; Vainik et al., 2019). All our analyses involving facets are exploratory, as no previous studies have examined associations between traveling abroad and personality at the level of facets.

2. Method

2.1. Participants

The participants of the present study are part of the Estonian Biobank cohort. It is a volunteer-based sample of about 200,000 individuals[2] that roughly corresponds to the age, gender, and geographic distribution of the Estonian adult population (Leitsalu et al., 2015). A small subsample of 381 participants agreed to take part in the present study.

The sample of the study was formed in the following way. First, a part of the Estonian Biobank was contacted for follow-up purposes during the period November 2012 to March 2014. In addition to taking part in several new and follow-up studies, they were also invited to participate in this study. Two-hundred and sixty-eight participants who had joined the biobank in the years 2002 to 2010 took up the invitation. The remaining participants (n = 113) of the study joined the biobank during the period October 2012 to January 2014. These people had either responded to the Estonian Biobank's public call to join the biobank, and consequently the present study, or had previously participated in earlier mobile positioning studies run by one of the co-authors of the article, and, thus, were recruited to participate in the present study, on the condition that they would also join the biobank. All the data were collected in a manner consistent with ethical standards for the treatment of human subjects. The study was not pre-registered.

The sample for the present study consists of 349 people (267 women, 76.50%), for whom both personality data (either self-reports or informant-ratings) and CDR were available. The mean age of the participants was 51.41 years (SD = 14.78, ranging from 22 to 86 years) at the time of collecting CDR in 2016. About 40 per cent of the participants (n = 137) had higher education, 31.23% had special secondary (vocational) education (n = 109), 24.26% had secondary education (n = 86), and 4.87% had elementary education (n = 17) at the time of joining the Estonian Biobank.[3] Education was coded into a dichotomous variable indicating whether one has higher education (1) or not (0).

Informant-ratings of personality were available for 307 (87.97%) participants. The mean age of informants (67.75% female, age unknown for five and gender unknown for three individuals) was 40.04 (SD = 14.50) years when completing the personality questionnaire. On average, informants had known target individuals for 23.74 (SD = 14.21) years. Among informants, 36.48% were spouses or partners, 24.76% were parents, 17.92% were friends, and the remaining 20.85% were other acquaintances or relatives (for two respondents, the relationship to the target was not known).

2.2. Measures

2.2.1. Personality traits

Personality traits were measured with the Estonian version of the NEO Personality Inventory-3 (NEO PI-3; McCrae, Costa, & Martin, 2005). The NEO PI-3 is a slightly modified version of the NEO PI-R questionnaire (Costa & McCrae, 1992; Kallasmaa, Allik, Realo, & McCrae, 2000). The questionnaire consists of 240 items that measure five broad domains—Neuroticism, Extraversion, Openness to Experience (Openness), Agreeableness, and Conscientiousness—and their 30 facets. Each facet is measured by 8 items that are answered on a 5-point Likert-like scale, ranging from 0 *(strongly disagree)* to 4 *(strongly agree)*.

For participants for whom both self-reports and informant-ratings were available (n = 303, 86.82%), a mean score of the two ratings was used in all analyses since informant-ratings are shown to provide a valuable complementary source of information to self-reports (Mõttus, Allik, & Realo, 2020). Self- and informant-reports of the NEO PI-3 personality domains correlated with each other in the expected magnitude: Pearson rs were 0.48 for Neuroticism, 0.57 for Extraversion, 0.51 for Openness to Experience, 0.53 for Agreeableness, and 0.42 for Conscientiousness (ps < 0.001). For 42 (12.03%) participants, only self-reports, and for four (1.15%) participants, only informant-ratings, were available, and thus, for those participants single ratings of personality were used. The personality data are part of the larger dataset that has been used in other studies (e.g., Kööts-Ausmees et al., 2016; Realo et al., 2015; Realo et al., 2017; Realo, van Middendorp, Kööts-Ausmees, Allik, & Evers, 2018) but they have not previously been used for the present purpose.

2.2.2. Call Detail Records (CDR)

The CDR used for this study comprises domestic and outbound roaming data collected by an Estonian mobile network operator (MNO). The data are passive mobile positioning data that are automatically stored in the memory or log files held by the MNO (Silm, Järv, & Masso, 2020). In 2015, the market share of the MNO in Estonia was about one-third, and its network covers nearly 99% of the area of Estonia. The CDR used in this study includes different activities done via the MNO (e.g., outgoing calls, outgoing text messages, incoming calls [only in outbound data], etc.) for the period of 12 months from February 1, 2016 to January 31, 2017. The average number of days between the first and last call activity was M = 351.64, SD = 54.26, ranging from 3 to 366 days. Three participants (0.86%) had<30 valid days of measurement and were excluded from further analyses; thus, the final sample for the analyses with CDR consisted of 346 individuals (265 females, mean age = 51.44, SD = 14.82, ranging from 22 to 86 years).

Using domestic and outbound roaming data, five indicators were generated to describe the participants' trips abroad (cf. Saluveer et al., 2020). The trips began and ended in Estonia and a trip could consist of several visits to different countries.

First, we generated a dichotomous variable indicating whether the participant had made at least one trip abroad (1 = they had used their phone abroad for outgoing calls, incoming calls, or outgoing text messages via the MNO) *versus* no trips abroad (0 = they had only used their phone in Estonia during the study period).

Next, the following four indicators were generated to describe the participants' trips abroad.

1. Number of trips abroad—the total number of unique trips abroad.

[2] https://genomics.ut.ee/en/access-biobank.

[3] While the share of people in our sample with higher education corresponds well to the general population—according to the OECD, 41% of Estonia's adult population (25–64 year olds) had attained tertiary education in 2018, https://www.oecd.org/education/education-at-a-glance/EAG2019_CN_EST.pdf, our sample was older and had more women than the Estonian population in general. According to the latest population census, women account for 52.4% of the population whereas the average age of people living in Estonia is 42.2 year, https://rahvaloendus.ee/en/uudised/rahvaloendus-eesti-rahvaarv-ja-eestlaste-arv-kasvanud.

2. Number of days spent abroad—the total number of days spent abroad across all trips calculated as the number of days on which any call activity was recorded via the MNO outside Estonia.
3. Number of countries visited—the total number of foreign countries visited during all trips.
4. The longest distance travelled abroad—the straight line distance in kilometers (km) from Tallinn (the capital of Estonia) to the capital of the furthest visited country across all trips abroad.

2.3. Procedure

Recruitment and data collection at the Estonian Biobank involved General Practitioners and other medical personnel in private practices and hospitals, but also the recruitment offices at the Estonian Biobank. Upon joining the Estonian Biobank, participants gave their informed consent, which can be found at https://www.geenivaramu.ee/en/access-biobank. The general procedure of data collection and assessments is described by Leitsalu and colleagues (2015). Whether it was their first or a follow-up session, all participants in the present study also signed the informed consent form and gave permission to use their personality data and CDR for the purposes of this study. Participants then chose whether they preferred completing the personality questionnaire online or using a paper copy. If they chose the online option, they were given both written and verbal instructions about how to complete the questionnaire online and two unique survey access codes: one for the participant and one for their informant. If they chose the paper option, they were given two copies of the questionnaire (again, one for themselves and one for their informant) and two stamped return envelopes. Most of the participants (n = 319, 92.46%) and informants (n = 284, 92.51%) completed the personality questionnaire online; the remaining participants and informants filled out the paper version of the questionnaire and sent it back to the biobank via mail upon completion.

The personality data were collected from October 2012 to December 2016. The majority of participants (93.91%, n = 324) and informants (90.88%, n = 279) completed the personality questionnaire in 2012–2015—that is, before the CDR collection period began in February 2016. Nineteen participants (5.51%) and 24 informants (7.82%) filled out the personality questionnaire in 2016 while the year of completion was unknown for 2 participants and 4 informants.

The data of this study cannot be publicly shared due to legal and ethical restrictions. For access to the data please apply at https://genomics.ut.ee/en/biobank.ee/data-access.

2.4. Data analyses

First, descriptive statistics were calculated for all five mobility indicators based on CDR. To examine whether there were any differences between the participants who had travelled abroad at least once *versus* the ones who had not in FFM personality trait scores, *t*-test analyses were performed separately for each NEO PI-3 domain and facet. A series of binary regression analyses was used to predict the categorical variable of trips abroad from personality domains and facets when also controlling for gender, age, and education. Associations between personality traits and mobility indicators related to trips abroad were examined using Pearson moment product correlations and partial correlations when controlled for age, gender, and education. Finally, in order to control for the effect of sociodemographic variables, as well as other personality traits, a series of hierarchical linear regression analyses was conducted in which each of the four mobility indicators (i.e., number of trips abroad, number of days spent abroad, number of countries visited, and the longest distance travelled) was predicted simultaneously from the NEO PI-3 domain scores, as well as from age, gender, and education in four separate models. All analyses were performed using IBM SPSS Statistics 27 (IBM Corporation, 2020).

As recommended by Benjamin and Berger (2019), we use a p-value of < 0.005 to indicate statistical significance and refer to findings with a p-value between 0.05 and 0.005 as "suggestive," rather than "significant.".

3. Results

3.1. Descriptive statistics of trips abroad

Out of 346 participants with complete CDR, 198 (57.23 %, mean age = 46.42 years, SD = 13.12; 75.76 % women; 43.43 % with higher education) had travelled abroad at least once during the study period. The participants who had visited a foreign country were younger than those who had not (mean age = 57.95 years, SD = 14.31), $t(347) = -7.81$, $p < 0.001$) but there were no significant differences in terms of gender (p =.672) or education (p =.265).

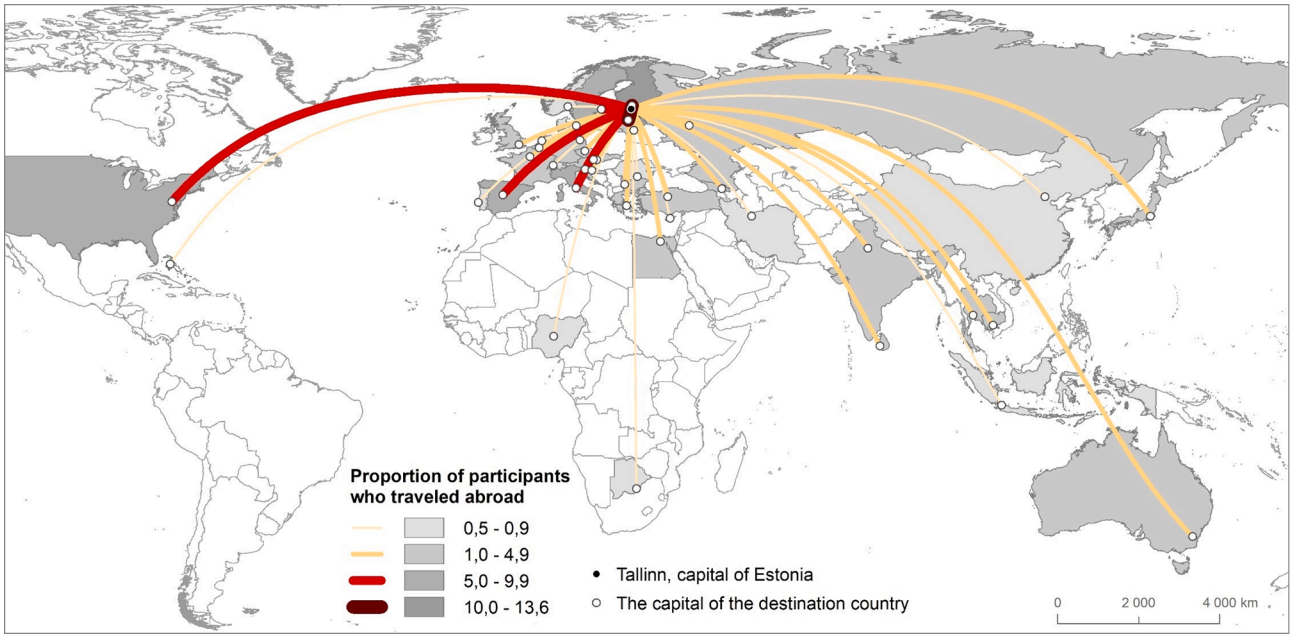

Fig. 1. The distribution of participants who had travelled abroad during the study period (n = 198) according to their furthest travel destination.

Table 1
Correlations among the Four Log-transformed Mobility Indicators Related to Trips Abroad, Age, Gender, and Education in the Subsample of Participants Who Had Travelled Abroad At Least Once During the Study Period.

	Pearson *r*					
	(1)	(2)	(3)	(4)	(5)	(6)
(1) Number of trips abroad	–					
(2) Number of days spent abroad	**0.73*****	–				
(3) Number of countries visited	**0.69*****	**0.70*****	–			
(4) Longest distance travelled abroad	**0.36*****	**0.54*****	**0.68*****	–		
(5) Age	**-0.21****	-0.12	**-0.30*****	**-0.21****	–	
(6) Gender	0.16*	0.19**	0.17*	0.10	-0.07	–
(7) Education	0.18*	0.11	0.16*	0.06	0.01	-0.01

Notes. $N = 198$. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$. Significant correlations at $p < 0.005$ are indicated in bold. (1) Number of trips abroad = the number of unique trips to another country during the study period; (2) Number of days spent abroad = the total number of days spent abroad across all trips, calculated as the number of days on which any call activity was recorded during the study period in a foreign country; (3) Number of countries visited = the total number of foreign countries visited with any recorded call activity during the study period; (4) Longest distance travelled abroad = the distance from Tallinn (the capital of Estonia) to the capital of the furthest visited country across all trips abroad during the study period; (5) Age in years; (6) Gender (1 = female, 2 = male); (7) Education = highest level of education obtained (0 = no higher education, 1 = higher education). The mobility indicators were log-transformed to conform with the assumptions of normality.

The participants ($n = 198$) who had travelled abroad during the study period made on average 3.75 trips abroad ($SD = 4.63$, ranging from 1 to 34 trips); spent on average 17.76 days abroad across all trips ($SD = 35.16$; ranging from less than a day to 277 days); and visited on average three different countries ($M = 3.01$, $SD = 2.65$, ranging from 1 to 17 countries). The longest distance travelled, that is, the distance from Tallinn (the capital of Estonia) to the capital of the furthest visited country across all trips abroad was $M = 2{,}274.54$, $SD = 2{,}696.28$, ranging from 82 (Helsinki, Finland) to 15,237 (Canberra, Australia) km. For 13.6 % of participants, the furthest destination travelled to was Latvia which borders Estonia in the South, followed by 10.6 % of the participants for whom Finland—the Northern neighbor of Estonia across the Gulf of Finland—was their furthest travel destination during the study period. The distribution of the participants according to their furthest travel destinations is presented in Fig. 1 and in Table S1 in Supplementary Material.

The descriptive statistics of the four mobility indicators are shown in Table S2 in Supplementary Material. All four indicators were highly skewed and leptokurtic and therefore, were transformed using the logarithmic function to meet the assumption of normal distribution more closely. After the log transformation, both skewness and kurtosis estimates of the four indicators were in acceptable range. The correlations among the four log-transformed mobility indicators related to trips abroad, age, gender, and education in the subsample of participants who had travelled abroad at least once during the study period ($n = 198$) are shown in Table 1. In brief, people who made more cross-border trips also spent more days abroad ($r = 0.73$), visited more countries ($r = 0.69$), and travelled further from their home country ($r = 0.36$), all significant at $p < 0.001$. All four log-transformed mobility indicators were significantly correlated with one other at $p < 0.001$. Age was also significantly and negatively correlated with all four mobility indicators at $p < 0.005$ except the number of days spent abroad. There were also several other suggestive correlations between sociodemographic variables and mobility indicators, as indicated in Table 1. For instance, gender and education were both positively correlated at $p < 0.05$ with the number of trips made ($rs = 0.16$ and 0.18, respectively) and with the number of countries visited ($rs = 0.17$ and 0.16, respectively), suggesting that males and people with higher education made more frequent trips abroad and visited more countries.

3.2. The personality characteristics of people who travelled abroad

Following the first aim of our study, we next examined whether the FFM personality traits—both domains and facets—allowed us to predict whether people have travelled abroad or not when also controlling for age, gender, and education.

3.2.1. Domains

There were no statistically significant differences at $p < .005$ between the participants who had travelled abroad at least once *versus* the ones who had not in their scores in the FFM personality domains (see Table S3a in Supplementary Material). Participants who had travelled abroad had higher levels of Extraversion ($M = 106.66$, $SD = 23.72$) and Openness ($M = 106.31$, $SD = 18.85$) than those who had not ($M = 100.25$, $SD = 23.25$ and $M = 100.58$, $SD = 18.87$), $t(344) = 2.51$ [*CFI* 1.39–11.42, $d = 0.27$] and 2.79 [*CFI* 1.69–9.75, $d = 0.30$]), but these differences were only suggestive at $p = 0.012$ and 0.006 for Extraversion and Openness, respectively.[4]

When we predicted the categorical variable of trips abroad (1 = yes, 0 = no) from Extraversion, as well as from gender, age, and education, in a binary regression analysis (see Table 2), age ($B = -0.06$, SE(B) = 0.01, *Wald* = 45.31, Exp*(B)* = 0.94, [CI 0.92–0.96], $p < 0.0001$) was the only significant predictor of trips abroad at $p < 0.005$. Education ($B = -0.52$, SE(B) = 0.25, *Wald* = 4.36, Exp*(B)* = 0.60, [CI 0.36–0.97]) made a suggestive contribution to the prediction of trips abroad at $p = .037$. Very similar findings were obtained when predicting trips abroad from Openness and the three sociodemographic variables—again, only age ($B = -0.06$, SE(B) = 0.01, *Wald* = 43.57, Exp(B) = 0.94, [CI 0.92–0.96], $p < 0.0001$) made a significant contribution to predicting trips abroad, whereas the contribution of other variables in the model did not reach the level of statistical significance at $p < .005$. Education ($B = -0.51$, SE (B) = 0.25, *Wald* = 4.06, Exp*(B)* = 0.60, [CI 0.36–0.99]) also suggestively contributed to the prediction of Openness at $p < 0.044$. Thus, Hypothesis 1 was not supported by the data, as there were no significant differences between the participants who had travelled abroad at least once *versus* the ones who had not in any of the NEO PI-3 domains when age, gender, and education were accounted for. It was age primarily and education to a lesser extent which contributed to the prediction of whether participants had made at least one trip abroad or not—younger participants and those with no higher education were more likely to travel abroad during the study period.

Since nearly 25 per cent of the participants who had made a cross-border trip during the study period had not travelled any further than to the neighboring countries Latvia and Finland, we also examined whether there were any differences in the FFM personality traits between the participants (a) who had not travelled abroad ($n = 148$), (b) who had Latvia and Finland as their furthest travel destinations ($n = 48$),

[4] As per the Reviewer's and the Editor's suggestions, we conducted most of the analyses also separately for self- and informant-ratings of personality. The results—which are shown in Supplementary Material (Tables S3b, S3c, S4b, S4c, S5, S6a, S6b, S7a, S7b, respectively)—were in principle quite similar regardless the type of personality ratings (i.e., self-, informant-, or the mean score of self-reports and informant-ratings) was used. As a general trend, self-reports of personality had more significant relationships with mobility indicators than informant-ratings, but these differences largely disappeared when the effect of sociodemographic factors was accounted for. Therefore, for brevity's sake, only the results using the mean scores of the self-reports and informant-ratings of personality are reported throughout the paper.

Table 2
The Results of the Binary Logistic Regression Analyses when Predicting Who Will Have Travelled Abroad (1) or Not (0) during the Study Period from the NEO PI-3 Extraversion and Openness to Experience Domains (Mean Scores of Self-reports and Informant-ratings) and Sociodemographic Variables.

	B	*SE*	*Wald*	*p*	Exp(*B*)	Lower CI	Upper CI
Extraversion (Nagelkerke $R^2 = 0.23$)							
Extraversion	0.01	0.01	2.65	0.103	1.01	1.00	1.02
Age	**−0.06**	**0.01**	**45.31**	**0.000**	**0.94**	**0.92**	**0.96**
Gender	0.00	0.29	0.00	0.997	1.00	0.57	1.75
Education	−0.52	0.25	4.36	0.037	0.60	0.36	0.97
Constant	2.94	0.80	13.65	0.000	18.94		
Openness to Experience (Nagelkerke $R^2 = 0.22$)							
Openness to Experience	0.01	0.01	0.88	0.349	1.01	0.99	1.02
Age	**−0.06**	**0.01**	**43.57**	**0.000**	**0.94**	**0.92**	**0.96**
Gender	0.04	0.28	0.02	0.899	1.04	0.60	1.81
Education	−0.51	0.25	4.06	0.044	0.60	0.36	0.99
Constant	3.12	0.98	10.14	0.001	22.73		

Note. $N = 346$. $df = 1$. *SE* = standard error of *B*. CI = 95 % confidence interval for Exp(*B*). Age = age in years; Gender (1 = female, 2 = male); Education = highest level of education obtained (0 = no higher education, 1 = higher education). Significant differences at $p < 0.005$ are indicated in bold.

and (c) who had travelled further than Latvia and Finland ($n = 150$) during the study period when also controlling for sociodemographic variables. To this aim, a series of ANCOVAs were conducted to compare the three groups on each of the FFM domains while controlling for age, gender, and education. The results are shown in Tables S4a to S4c in Supplementary Material. There were no statistically significant differences at $p < 0.005$ between the three groups in any of the domain scores of the NEO PI-3 when controlling for the effects of age, gender, and education.

3.2.2. Facets

The mean scores of the NEO PI-3 facets for the participants who had either travelled abroad or not during the study period are shown in Table S3a in Supplementary Material. The participants who had visited a foreign country had significantly higher scores on E5: Excitement-seeking, O4: Openness to Actions, and O6: Openness to Values (all significant at $p < .0001$), but lower scores on A6: Tendermindedness ($p < .0001$), than those who had not made any trips abroad. There was also suggestive difference between the two groups of participants in their levels of O1: Openness to Fantasy ($p < 0.009$), C3: Dutifulness ($p < 0.032$), and C6: Deliberation ($p < 0.014$). Again, when controlled for age, gender, and education in a series of binary regression analyses for each of the seven personality facets separately (please see Table 3), age was consistently the most significant predictor of trips abroad at $p < 0.0001$. Education made a suggestive contribution with *p*-values ranging from 0.022 to 0.027 to predicting who had travelled abroad or not in all models except two that included O4: Openness to Action and O6: Openness to Values. In addition to age, only one of the NEO PI-3 personality facets—O6: Openness to Values ($B = 0.14$, SE(B) = 0.04, *Wald* = 9.53, Exp(*B*) = 1.15, [CI 1.05–1.25], $p < 0.002$)—remained a statistically significant predictor of whether a participant had travelled abroad at $p < 0.005$ when sociodemographic factors were controlled for. The role of E5: Excitement-seeking ($B = 0.06$, SE(B) = 0.03, *Wald* = 5.93, Exp(*B*) = 1.07, [CI 1.01–1.12], $p = .015$), and O4: Openness to Action ($B = 0.07$, SE(B) = 0.03, *Wald* = 5.79, Exp(*B*) = 1.08, [CI 1.01–1.14], $p = .016$) in predicting travel abroad when sociodemographic variables are accounted for can also tentatively be suggested.

3.3. Associations between personality traits and mobility indicators related to trips abroad

The second aim of the study was to find out whether FFM personality traits are significantly related to the frequency and length of trips abroad, the number of countries visited, and the longest distance travelled when controlled for respective sociodemographic variables. To this aim, we examined the Pearson moment product correlations between the NEO PI-3 domain and facet scales and the four mobility indicators related to trips abroad, and the respective partial correlations when controlled for age, gender, and education (see Table 4).

At the level of the NEO PI-3 domains, only Extraversion was significantly and positively correlated with any mobility indicators related to trips abroad at $p < 0.005$ when also sociodemographic factors were accounted for. Namely, participants with higher levels of Extraversion had made more trips abroad ($r' = 0.21$, $p = 0.004$) and had visited more countries ($r' = 0.22$, $p = 0.002$) than those with lower levels of Extraversion.

At the level of facet scales, three facets of Extraversion (i.e., E2: Gregariousness, E3: Assertiveness, and E4: Activity) and one facet scale of Openness (i.e., O6: Values) showed significant positive, whereas one facet of Openness (i.e., O2: Aesthetics) and one facet of Conscientiousness (i.e., C6: Deliberation) significant negative, correlations with some of the mobility indicators related to trips abroad at $p < 0.005$ when age, gender, and education were controlled for. People who had made more frequent trips abroad had significantly higher levels of E3: Assertiveness ($r' = 0.24$), E4: Activity ($r' = 0.23$), and lower levels of C6: Deliberation ($r' = -0.23$). The number of days spent abroad correlated significantly and positively with O6: Openness to Values ($r' = 0.20$) and negatively with Openness to Aesthetics ($r' = -0.22$). People who had visited more countries while traveling abroad scored higher on E2: Gregariousness ($r' = 0.21$), E3: Assertiveness ($r' = 0.32$), E4: Activity ($r' = 0.27$) and lower on C6: Deliberation ($r' = -0.21$). Finally, it was participants with higher levels of E3: Assertiveness ($r' = 0.24$) who travelled significantly further from their home country than those had lower scores on those facet scales.

In order to control for the effect of age, gender, and educational level, as well as of other personality traits, a series of hierarchical linear regression analyses was conducted in which each of the four mobility indicators (i.e., number of trips abroad, number of days spent abroad, number of countries visited, and the longest distance travelled) was predicted simultaneously from the NEO PI-3 domain scores as well as from age, gender, and education in four separate models. For each mobility indicator, personality traits were entered into the model in Block 1 and sociodemographic variables in Block 2. The results of the hierarchical linear regression analyses are shown in Tables S8-S11 in Supplementary Material. In order to avoid over-fitting, the respective analyses were not conducted for the NEO PI-3 facet scales.

All eight variables accounted for 13 per cent of the variance in the number of cross-border trips, with higher Extraversion ($\beta = 0.29$, $p < 0.005$) and younger age ($\beta = -0.20$, $p < 0.005$) being significant predictors of more frequent trips abroad at $p < 0.005$. Thus, Hypothesis 2 was partially confirmed—people who scored higher on Extraversion but not on Openness had made more frequent trips abroad.

Hypothesis 3 was not confirmed as neither Extraversion nor Agreeableness, as we hypothesized, significantly predicted the number of days spent abroad across all trips at $p < 0.005$, with all independent variables explaining 6% of the variance.

Table 3
The Results of Binary Logistic Regression Analyses when Predicting Who Will Have Travelled Abroad (1) or Not (0) during the Study Period from the NEO PI-3 Facets (Mean Scores of Self-reports and Informant-ratings) and Sociodemographic Variables.

	B	*SE*	*Wald*	*p*	Exp(*B*)	Lower CI	Upper CI
E5: Excitement-seeking (Nagelkerke $R^2 = 0.24$)							
E5	0.06	0.03	5.93	0.015	1.07	1.01	1.12
Age	**−0.06**	**0.01**	**37.23**	**0.000**	**0.94**	**0.93**	**0.96**
Gender	0.15	0.29	0.27	0.604	1.16	0.66	2.05
Education	−0.57	0.25	5.21	0.022	0.56	0.34	0.92
Constant	2.67	0.74	12.92	0.000	14.37		
O1: Openness to Fantasy (Nagelkerke $R^2 = 0.22$)							
O1	0.01	0.03	0.08	0.772	1.01	0.96	1.06
Age	**−0.06**	**0.01**	**42.79**	**0.000**	**0.94**	**0.92**	**0.96**
Gender	0.04	0.28	0.02	0.894	1.04	0.60	1.81
Education	−0.56	0.25	4.95	0.026	0.57	0.35	0.94
Constant	3.73	0.79	22.32	0.000	41.51		
O4: Openness to Actions (Nagelkerke $R^2 = 0.24$)							
O4	0.07	0.03	5.79	0.016	1.08	1.01	1.14
Age	**−0.06**	**0.01**	**41.87**	**0.000**	**0.94**	**0.93**	**0.96**
Gender	0.10	0.29	0.11	0.738	1.10	0.63	1.93
Education	−0.45	0.25	3.20	0.074	0.63	0.39	1.04
Constant	2.52	0.78	10.41	0.001	12.48		
O6: Openness to Values (Nagelkerke $R^2 = 0.25$)							
O6	**0.14**	**0.04**	**9.53**	**0.002**	**1.15**	**1.05**	**1.25**
Age	**−0.05**	**0.01**	**31.60**	**0.000**	**0.95**	**0.93**	**0.97**
Gender	0.05	0.29	0.03	0.872	1.05	0.60	1.84
Education	−0.46	0.25	3.32	0.068	0.63	0.38	1.04
Constant	0.71	1.14	0.39	0.534	2.04		
A6: Tendermindedness (Nagelkerke $R^2 = 0.23$)							
A6	−0.06	0.04	2.51	0.113	0.95	0.88	1.01
Age	**−0.06**	**0.01**	**42.08**	**0.000**	**0.94**	**0.92**	**0.96**
Gender	0.14	0.29	0.22	0.636	1.15	0.65	2.03
Education	−0.55	0.25	4.89	0.027	0.58	0.35	0.94
Constant	4.88	0.87	31.70	0.000	131.92		
C3: Dutifulness (Nagelkerke $R^2 = 0.23$)							
C3	−0.05	0.04	1.64	0.200	0.95	0.88	1.03
Age	**−0.06**	**0.01**	**44.85**	**0.000**	**0.94**	**0.92**	**0.96**
Gender	0.15	0.30	0.26	0.611	1.16	0.65	2.08
Education	−0.57	0.25	5.26	0.022	0.56	0.35	0.92
Constant	4.94	1.02	23.63	0.000	140.16		
C6: Deliberation (Nagelkerke $R^2 = 0.23$)							
C6	−0.04	0.03	2.74	0.098	0.96	0.91	1.01
Age	**−0.06**	**0.01**	**44.83**	**0.000**	**0.94**	**0.92**	**0.96**
Gender	0.09	0.29	0.10	0.747	1.10	0.63	1.92
Education	−0.57	0.25	5.26	0.022	0.56	0.34	0.92
Constant	4.66	0.75	38.48	0.000	105.64		

Note. $N = 346$. $df = 1$. *SE* = standard error of *B*. CI = 95 % confidence interval for Exp(*B*). Age = age in years; Gender (1 = female, 2 = male); Education = highest level of education obtained (0 = no higher education, 1 = higher education). Significant differences at $p < 0.005$ are indicated in bold.

Extraversion ($\beta = 0.32$, $p < 0.0001$) and age ($\beta = -0.29$, $p < 0.0001$) were the most significant predictors of how many countries participants had visited over the study period. The contribution of education ($\beta = 0.17$, $p = 0.010$), Openness ($\beta = -0.19$, $p = 0.017$), and gender ($\beta = 0.14$, $p = 0.045$) to predicting the number of countries the participants had visited was suggestive. This rejects Hypothesis 4 that higher Openness is significantly related to a higher number of countries visited during the study period. All eight variables accounted for 18% of the total variance in the number of foreign countries visited.

Finally, the longest distance travelled was significantly predicted by age ($\beta = -0.20$, $p < 0.005$) whereas Extraversion ($\beta = 0.24$, $p = 0.006$) made a suggestive contribution, with all independent variables explaining 6% of the variance. Hypothesis 5 was, therefore, partially confirmed as it was only people with higher levels of Extraversion, but not those with lower levels of Neuroticism, who travelled longer distances when abroad.

4. Discussion

In the era of mass tourism and transnational migration, traveling abroad is a rather mundane activity undertaken by several hundred thousand people each and every day (Levitt & Jaworsky, 2007; United Nations World Tourism Organization, 2019). Yet, studies conducted over the last decades have shown that there are clear individual differences in people's intentions to travel abroad as well as in their propensity to relocate to another country on a more permanent or temporary basis (see Oishi & Tsang, 2022, for a review). Our study aimed to advance the field by examining what personality traits are characteristic to people who are more inclined to travel abroad compared to those who stay at home. More specifically, we examined associations between the FFM personality traits and cross-border mobility in a sample of adults by using their roaming CDR over a 12-month period.

Our first research question pertained to the role of the FFM personality traits in predicting people's trips abroad. Overall, about 57 per cent of the participants of the study had travelled abroad at least once during the study period. We did not find support for Hypothesis 1, as there were no significant differences in any of the NEO PI-3 domains between the participants who had travelled abroad at least once during the study period and the ones who had not, when age, gender, and education were controlled for. Nearly 25 per cent of the participants who had made a cross-border trip during the study period had not travelled any further

Table 4
Pearson Moment Product Correlations between the Four Log-transformed Mobility Indicators related to Trips Abroad and the NEO PI-3 Domain and Facet Scales (Mean Scores of Self-reports and Informant-ratings) and Partial Correlations when Controlled for Age, Sex, and Education in the Subsample of Participants Who Had Travelled Abroad At Least Once.

	Number of trips abroad		Number of days abroad		Number of countries visited		Longest distance travelled	
NEO PI-3	*r*	*r'*	*r*	*r'*	*r*	*r'*	*r*	*r'*
Domains								
Neuroticism	−0.03	−0.08	−0.09	−0.06	−0.03	0.00	−0.04	−0.03
Extraversion	**0.24****	**0.21****	0.13	0.11	**0.25****	**0.22****	0.18*	0.16*
Openness to Experience	0.08	0.00	0.00	−0.05	0.07	−0.02	0.02	−0.03
Agreeableness	−0.15*	−0.08	−0.16*	−0.10	−0.16*	−0.08	−0.08	−0.02
Conscientiousness	−0.09	−0.08	−0.08	−0.06	−0.10	−0.09	0.03	0.04
Facets								
N1: Anxiety	−0.10	−0.07	−0.11	−0.07	−0.03	0.01	0.02	0.03
N2: Angry Hostility	0.03	0.05	−0.05	−0.04	0.05	0.07	0.00	−0.01
N3: Depression	−0.07	−0.01	−0.10	−0.04	−0.03	0.03	−0.05	−0.02
N4: Self-conscientiousness	−0.08	−0.08	−0.08	−0.08	−0.06	−0.08	−0.06	−0.08
N5: Impulsiveness	0.14*	0.16*	0.04	0.06	0.08	0.09	0.02	0.01
N6: Vulnerability to Stress	−0.06	−0.03	−0.15*	−0.12	−0.16*	−0.14	−0.11	−0.10
E1: Warmth	0.04	0.05	−0.03	−0.02	0.05	0.08	0.07	0.09
E2: Gregariousness	0.18*	0.17*	0.13	0.14	**0.21****	**0.21****	0.17*	0.17*
E3: Assertiveness	**0.28****	**0.24****	**0.21****	0.17*	**0.35****	**0.32****	**0.25****	**0.24****
E4: Activity	**0.24****	**0.23****	0.09	0.08	**0.27****	**0.27****	0.18*	0.17*
E5: Excitement seeking	**0.22****	0.15*	0.14*	0.08	0.17*	0.07	0.13	0.06
E6: Positive emotions	0.07	0.06	0.01	0.02	0.05	0.02	−0.01	−0.03
O1: Openness to Fantasy	0.06	0.00	0.00	−0.04	0.04	−0.06	0.01	−0.05
O2: Openness to Aesthetics	−0.18*	−0.19**	**−0.23****	**−0.22****	−0.18*	−0.18**	−0.12	−0.11
O3: Openness to Feelings	0.07	0.05	−0.08	−0.09	0.02	−0.03	0.00	−0.03
O4: Openness to Actions	0.19**	0.14	0.13	0.09	**0.22****	0.16*	0.08	0.04
O5: Openness to Ideas	0.09	−0.01	0.07	−0.02	0.10	−0.01	0.05	−0.01
O6: Openness to Values	**0.20****	0.15*	**0.23****	**0.20****	**0.23****	0.17*	0.14	0.10
A1: Trust	0.06	0.08	−0.01	0.01	0.06	0.09	0.03	0.05
A2: Straightforwardness	−0.12	−0.09	−0.09	−0.06	−0.15*	−0.12	−0.12	−0.10
A3: Altruism	−0.12	−0.11	−0.13	−0.12	−0.10	−0.09	0.00	0.02
A4: Compliance	−0.13	−0.07	−0.11	−0.07	−0.18*	−0.12	−0.12	−0.08
A5: Modesty	**−0.23****	−0.12	−0.18*	−0.10	**−0.22****	−0.10	−0.11	−0.03
A6: Tendermindedness	−0.09	0.00	−0.16*	−0.10	−0.09	0.02	−0.01	0.06
C1: Competence	0.01	−0.01	0.03	0.01	0.03	0.02	0.06	0.05
C2: Order	−0.09	−0.06	−0.08	−0.04	−0.07	−0.03	0.04	0.06
C3: Dutifulness	**−0.20****	−0.15	−0.18*	−0.13	**−0.24****	−0.19**	−0.09	−0.04
C4: Achievement Striving	0.14*	0.08	0.02	−0.03	0.08	0.00	0.10	0.06
C5: Self-discipline	−0.05	−0.02	−0.03	0.02	−0.04	0.00	0.04	0.06
C6: Deliberation	**−0.24****	**−0.23****	−0.16*	−0.13	**−0.23****	**−0.21****	−0.06	−0.04

Notes. $N = 198$. $^{**}p < 0.01$, $^{*}p < 0.05$. Significant correlations at $p < 0.005$ are shown in bold.
r = Pearson moment product correlation; *r'* = Partial correlation when controlled for age, gender (1 = female, 2 = male) and education (0 = no higher education, 1 = higher education). Number of trips abroad = the number of unique trips to a foreign country during the study period; Number of days spent abroad = the total number of days spent abroad across all trips, calculated as the number of days on which any call activity was recorded during the study period in a foreign country; Number of countries visited = the total number of foreign countries visited with any recorded call activity during the study period; Longest distance travelled = the maximum distance from Tallinn (the capital of Estonia) to the capital of the furthest visited country across all trips abroad during the study period. The mobility indicators were log-transformed to conform with the assumptions of normality.

than to the neighboring countries Latvia and Finland which are also among the most popular travel destination for Estonians in general.[5] However, we also did not find any significant differences in the FFM personality traits between the participants who had not travelled abroad, who had Latvia and Finland as their furthest travel destinations or who had travelled further than Latvia and Finland during the study period when also controlling for sociodemographic variables.

At the level of facets, though, our findings showed that it was not only younger people, but also participants with higher levels of Openness to Values (O6), and suggestively also of Openness to Action (O4) and Excitement-seeking (E5), who were are more likely to have made at least a single trip across the border during the period of 12 months. Several earlier studies have emphasized the role of Openness in predicting people's mobility intentions (Paulauskaite et al., 2010; Pungas et al., 2015; Tabor et al., 2015) as well as their actual permanent or temporary move (Camperio Ciani et al., 2007; Jokela, 2009; Lüdtke et al., 2011; Zimmermann & Neyer, 2013) over and above relevant sociodemographic indicators, but our findings indicate that it is primarily only one (or two) facets of Openness that are responsible for this relationship, supporting the idea that narrower facets of the FFM domains are often more closely associated with different behavioral outcomes than outcomes of the FFM domains alone (Paunonen & Ashton, 2001; Vainik et al., 2019). According to Costa and McCrae (Costa & McCrae, 1992), Openness to Values (O6) can be described as "the readiness to reexamine social, political, and religious values. Closed individuals tend to accept authority and honor tradition and as a consequence are generally conservative," whereas O4: Openness to Action is "seen behaviorally in the willingness to try different activities, go new places, or eat unusual foods. High scorers on this scale prefer novelty and variety to familiarity and routine" (p. 17). This relates well to findings that have shown that Openness is associated with lower levels of collectivism (Realo, Allik, & Vadi, 1997) and also with an inclination to leave one's community, move to the frontier, or settle in harsher and unknown environments (Feng, Ren, & Ma, 2017; Götz, Stieger, Gosling, Potter, & Rentfrow, 2020; Kitayama, Ishii, Imada, Takemura, & Ramaswamy, 2006).

Also E5: Excitement-Seeking has been shown to be associated with a tendency to engage in highly stimulating activities, such as sky-diving

[5] https://www.eestipank.ee/press/eesti-elanikud-reisivad-uha-rohkem-08022018.

(Ausmees et al., 2021) and other adventure sports, but also to consume exotic meals and be involved in illegal activities (Aluja, Garcia, & Garcia, 2003; Zuckerman, 1994). Several meta-analyses have also confirmed significant associations between novelty- or excitement-seeking and DRD4 (He, Martin, Zhu, & Liu, 2018; Munafò, Yalcin, Willis-Owen, & Flint, 2008), the so-called *Wanderlust* gene, which is believed to be responsible for the urge to travel and migrate (Chen, Burton, Greenberger, & Dmitrieva, 1999; Eisenberg, Campbell, Gray, & Sorenson, 2008). However, when interpreting these findings one should be constantly mindful of the fact that age outperformed—and mostly by a large margin—the effect of personality traits on travelling abroad for all examined traits.

Our second aim was to find out whether FFM personality traits are significantly related to the frequency and length of trips abroad, the number of countries visited, and the longest distance travelled when also controlling for age, gender, and education. Overall, our findings showed that, at the domain level, only Extraversion significantly predicted the number of trips made abroad, the number countries visited, and the furthest country visited (suggestively). This is consistent with earlier research that has indicated the significant role of Extraversion both in intra- and international migration propensity (Camperio Ciani et al., 2007; Jokela, 2009; Silventoinen et al., 2008), as well as in short-term sojourning (Lüdtke et al., 2011; Ward, Leong, & Low, 2004; Zimmermann & Neyer, 2013). Our research, however, contributes to the existing research by showing that not all facets of Extraversion are equally responsible for people's travel abroad and that different facets of Extraversion are related to different aspects of temporary mobility. E3: Assertiveness was significantly associated with all four mobility indicators except the number of days spent abroad, whereas people scoring higher on E2: Gregariousness tended to visit more countries and those higher on E4: Activity made more trips abroad and to a higher number of different countries. All of these three facets of Extraversion can be seen as indicators of agentic Extraversion (Depue & Collins, 1999) or linked together by reward sensitivity, which, according to some authors, is the core of Extraversion (e.g., Lucas, Diener, Grob, Suh, & Shao, 2000). Overall, it seems that it is primarily the more dominant and socially ascendant people, but also the more active and gregarious individuals, who are more inclined to travel abroad and visit different places.

We also hypothesized that people who scored higher on Openness had made more frequent trips abroad and to a higher number of countries. While our data did not confirm this for the domain of Openness, we found that two facets of Openness—O2: Aesthetics and O6: Values—had significant associations with mobility measures when age, gender, and education were controlled for. People scoring higher on O6: Openness to Values spent more days abroad, whereas those with higher levels of O2: Aesthetics spent less days abroad in total. Previous research has indicated that O6: Values shows a consistent association with the 5-HTTLPR genotype and the cerebral plasma membrane serotonin transporter (5-HTT) which, in turn, has been shown to contribute to behavioral and cognitive flexibility *versus* rigidity (Kalbitzer et al., 2009). It is more difficult to explain the negative effect of O2: Aesthetics on the number of days spent abroad. As per definition, "High scorers on this scale have a deep appreciation for art and beauty. /…/ Low scorers are relatively insensitive to and uninterested in an and beauty" (Costa & McCrae, 1992, p. 17). What is noteworthy, though, is that this is another example of how the facets of the same domain can have correlations with different signs with the same outcome or behavioral measure.

Finally, people who had made more frequent trips abroad and visited more countries also had significantly lower levels of C6: Deliberation. Interestingly, these are the exact same traits—a failure to plan ahead and think carefully before acting—that have been shown to be responsible for the association between externalizing disorders, such as substance use disorders and antisocial personality disorder, and Conscientiousness (Naragon-Gainey & Simms, 2017; Ruiz, Pincus, & Schinka, 2008). C6: Deliberation, together with E5: Excitement seeking, have also been found to be at the core of the "hedonic" subtype of psychological gambling (Vachon & Bagby, 2009).

Across all our analyses, age was the most consistent predictor of most aspects of people's trips abroad. This is in line with recent trends which indicate that spatial mobility declines linearly with age (Masso et al., 2019) and that the millennial generation (those currently between the ages of 16 and 34) is traveling abroad more often than older generations, is taking longer trips both in terms of distance and time, and is exploring more exotic and remote destinations (Machado, 2014). Apart from age, the effect of other sociodemographic factors was relatively weak and inconsistent.

4.1. Strengths and limitations of our study

An innovative aspect of our study was that, instead of asking participants about their intentions to move or travel or their self-reported accounts of trips abroad, participants' travel records over a 12-month period were obtained by analyzing their mobile positioning data. The use of mobile phones to collect behavioral data has greatly increased over the last decades and is considered to have excellent ecological validity (Harari et al., 2016). As for personality measurement, both self-reports and informant-ratings were used. By using different modes of measurement in our study, we effectively mitigated the effects of self-report biases as well as reduced concerns about common method variance (Fiske, 1982; Paulhus & Vazire, 2007). Thus, in line with previous studies which have shown that CDR can successfully be used to analyze people's cross-border mobility and dynamics (Ahas et al., 2017; Mooses et al., 2020; Silm et al., 2021), and that people's daily spatial behavior can be predicted from their personality traits (Ai et al., 2019), our findings demonstrated that personality traits, especially lower-level facets, can be also helpful in predicting the number, length, diversity, and maximum distance of cross-border trips. While this was not a causal study of the relationships between the FFM personality traits and temporal cross-border mobility, our study design was consistent with the assumption that personality leads to mobility and not the reverse. For most of our participants, personality was measured before the CDR collection period began. Thus, the temporal order of the measurement of the variables related to personality and mobility was in line with the presumed causal order of effects.

It is also important to note that, differently from previous studies on temporary mobility (Lüdtke et al., 2011; Zimmermann & Neyer, 2013), our sample included adults, not just students, in an age range spanning more than 60 years. The share of people in our sample with higher education also corresponded well to the general population, so, even if we cannot claim that our sample was representative of the whole population in the strictest sociological sense, it consisted of people with diverse sociodemographic characteristics.

Notably, our study also had some important limitations. First, as with any Big Data, CDR come with both opportunities and challenges. The good thing about CDR is that it is a very rich data set that can be used to analyze the spatial and temporal aspects of human mobility. Relatedly, one of the common challenges is the identification of meaningful and valuable metrics that are capable of measuring the variables of interest in a valid and reliable way. Therefore, our choice of mobility indicators was grounded in the existing research that have successfully used CDR to analyze people's cross-border mobility (cf. Saluveer et al., 2020) but it is of course possible that using a different set of more fine-grained indicators may have uncovered some more nuanced relationships between personality traits and traveling abroad.

Using CDR and not asking people about their trips abroad also means that we do not know their reasons for traveling (or not traveling) abroad. It may be that people with different motives for traveling abroad also differ in their personality traits. For instance, some people may frequently travel abroad because of their work, and thus, one could argue that traveling is a demand placed on them at work. However, a counterargument would be that it is a well-established fact that people's

personality traits are very good predictors of their occupational choice (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007) and that different occupations have distinctive psychological, including personality, profiles (Kern, McCarthy, Chakrabarty, & Rizoiu, 2019), and therefore, personality traits may predispose people to choose certain jobs over others, which may involve activities such as traveling, for instance, that fit people's interests.

Another limitation of the study concerns the use of mobile phones while abroad. It is possible that our participants may have switched off their phones while abroad to avoid roaming fees or that they never made or received any calls, never sent any texts, or turned on their mobile data when traveling abroad. We do not have any statistics about how many people in general would not use their phones when traveling abroad, but we believe that it is the exception rather than the norm. CDR has been used in many recent studies to evaluate outbound cross-border mobility (e.g., Masso et al., 2019; Saluveer et al., 2020; Silm et al., 2021), and even Eesti Pank (the central bank of Estonia) has been publishing international travel statistics based on mobile positioning since 2012.[6]

We also acknowledge the fact that the magnitude of the effects may seem rather small at the first glance, as most of the significant correlations and regression coefficients lie in the range of 0.20 to 0.35. Yet, as recently argued by Funder and Ozer (2019), an effect-size r of 0.30 in psychological research "indicates a large effect that is potentially powerful in both the short and the long run" and that an effect size of $r = 0.40$ or greater "is likely to be a gross overestimate that will rarely be found in a large sample or in a replication" (p. 156).

Last but certainly not least—the study was conducted before the outbreak of the COVID-19 pandemic, which dramatically reduced the amount of international travel. In absolute numbers, there were some 460 million less international tourist arrivals in the first five months of 2021 than in the same period of 2019 (United Nations World Tourism Organization, 2021). Even though international tourism shows strong signs of recovery with international arrivals reaching nearly 60 % of pre-pandemic levels in the first seven months of 2022,[7] several challenges remain and therefore, international tourism is not expected to return to pre-pandemic levels before 2024 or even later.[8] Thus, it would be interesting to explore if, and to what extent, the findings of the current study are replicated when measuring mobility during the pandemic or post-pandemic period.

5. Conclusion

Taken together, our findings once more indicate the importance of studying personality at a more fine-grained level. A modern-day traveler has a specific personality profile, involving facets from multiple FFM domains—they are likely not just younger but also open to new values (O6) and experiences (O4), as well as seeking novelty and excitement (E5). Higher Extraversion, especially higher levels of social dominance (E3) and energy (E4), and higher spontaneity (C6), also play a role in predicting how often people travel abroad and how many different countries they visit. Altogether, these findings cautiously support the notion of the "mobile personality," in the sense that there seem to be some predisposing personality factors that may make some more likely to embark on a journey from the comfort of their home to a neighboring or a faraway land.

[6] https://www.eestipank.ee/en/press/eesti-pank-starts-publishing-international-travel-statistics-06032012

[7] https://www.unwto.org/news/international-tourism-back-to-60-of-pre-pandemic-levels-in-January-July-2022.

[8] https://aci.aero/2022/06/28/the-impact-of-covid-19-on-airportsand-the-path-to-recovery/.

6. Data availability statement

The study was approved by the Research Ethics Committee of the University of Tartu (no. 2I3IT-12) on the 19 March 2012. The study was not pre-registered and we do not have permission to share the data openly, because of data access restrictions.

Declaration of Competing Interest

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

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jrp.2023.104355.

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