Citation: Úbeda, Y., Serra, R., Rivas, A., Villaespesa, F., Fatjó, J., Llorente, M., & Asensio, V. (2021). Iberian Lynx (*Lynx pardinus*) personality: A rating assessment with ex situ conservation programme sample. *Journal of Comparative Psychology*, *135*(3), 360-369. https://doi.org/10.1037/com0000276

Iberian Lynx (*Lynx pardinus*) Personality: A Rating Assessment With *Ex Situ* Conservation Program Sample.

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The authors wish to thank all the raters from the Iberian Lynx Ex Situ Conservation Program for helping in the personality questionnaire assessment. ML has been partly supported by “la Caixa” Foundation (LCF/PR/PR17/11120020) and is a Serra Húnter Fellow.

Abstract

Research on felid personality has been conducted in a few species. Thus, research on new species could be highly informative in regards to the influence that adaptation to different ecological challenges has on felid personality. We evaluated the personality of 58 Iberian lynxes (*Lynx pardinus*) hosted at three different breeding centers for reintroduction. Forty-three adjectives obtained from previous studies with felids were assessed by thirty raters according to the knowledge on the lynx behavior they acquired by observing a live video feed of the animals. Principal Components Analysis and Regularized Exploratory Factor Analysis revealed four factors with acceptable standards of inter-rater reliability. Based on the pattern of factor loadings and on previous labelling in felid personality research, we labelled the factors as: Neuroticism, Dominance, Impulsiveness, and Attentiveness. The results were similar to the previous studies on felids, although some differences were found, which could be due to evolutionary distance among species and to methodological differences among studies. Future research on endangered felids could provide insights into the influence of personality on conservation outcomes related to successful breeding and reintroduction.

Keywords: Iberian Lynx; personality; temperament; felids; rating

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Animal personality research has been assessed across a wide range of different taxa (see Hill et al., 2020 for a review) and most animal studies have been focusing on non-human primates, with more than 210 articles (Freeman & Gosling, 2010). After canids, felids are the third most commonly studied species group with at least 24 research articles, mainly in domestic cats (*Felis silvestris catus)* (Gartner, 2015). To our knowledge, personality studies on wild felids have been carried out only on seven species, including: tigers (*Panthera tigris;* Pastorino, Paini, et al., 2017; Phillips & Peck, 2007), cheetahs (*Acinonyx jubatus;* Baker & Pullen, 2013; Chadwick, 2014; McKay, 2003; Razal et al., 2016; Wielebnowski,1999), snow leopards (*Pantera uncia;* Gartner & Powel, 2012; Gartner et al., 2014), clouded leopards (*Neofelis nebulosa*; DeCaluwe et al., 2013; Gartner et al., 2014;), Scottish wildcats (*Felis silvestris grampia;* Gartner & Weiss, 2013a) African lions (*Panthera leo;* Gartner et al., 2014; Torgerson-White & Bennet, 2014), and Asiatic lions (*Pantera leo persica;* Pastorino, Viau, et al., 2017).

Personality of felids in particular, and of animals in general, is estimated by two main methods: behavior coding and trait rating (Freeman & Gosling, 2010; Gosling, 2001; Highfill et al., 2010; Vazire & Gosling, 2004). Both approaches have pros and cons, and choosing one is a matter of trade-offs (Freeman et al., 2011). However, even though trait ratings are sometimes criticized for being considered subjective and having different weighting in salient events, they are suggested to be (a) more reliable than behavioral coding, (b) they enable rapid collection of data, (c) that trait ratings are measuring real attributes of the assessed individuals, and (d) the method summarizes measures across time controlling for animal variability (Freeman et al., 2011; Freeman

& Gosling, 2010; Vazire et al., 2007). For these reasons, zoo animal personality is most commonly assessed (87%) through the use of the rating method (Tetley & O'Hara, 2012).

The adjectives used for the rating method can be generated by bottom-up approach, which uses species-specific traits, or by top-down or bottom-up approach which applies an already established scale from one species to another (Freeman et al., 2013; Uher, 2008). The first is often a better representation of species-specific personality, while the second is advantageous because it facilitates cross-species comparison, but can lead to the inclusion of irrelevant traits for the species being assessed as well as to the exclusion of traits that may be relevant to the targeted species (Freeman et al., 2013; Uher, 2008). The use of both approaches on the same species decreases the ability to make comparisons. If we use domestic cat personality research (*Felis silvestris catus*) as example, we found that both top-down approach of Bennett et al. (2017) and bottom-up approach of Ha & Ha (2017), identified five factors for the species. However, most of the adjectives used in Bennett and colleagues study, were not used in Ha & Ha study. Thus, a quantitative comparison cannot be done on these two five-factor solutions.

To address the limitations of bottom-up and top-down methods, a third approach based on the combination of both is applied by some studies because it uses species-specific traits and it facilitates cross-species comparison (Freeman et al., 2013; Gartner & Weiss, 2013a; Gosling, 1998). Similarly, a fourth approach could be used to facilitate cross-species comparison among the same biological family; namely, to choose adjectives exclusively used within the same biological family. Some studies on felids have used items from previous felid personality assessments, although some of them in combination with previous primate personality adjectives (Gartner & Powell, 2012;

Gartner & Weiss, 2013a; Gartner et al., 2014; Litchfield et al., 2017). Thus, an approach exclusively based on traits found within the same biological family could be highly informative from a comparative perspective.

As in previous animal personality research, most of the felid personality studies have been focused on identifying personality traits by extracting the structure of personality from the species (Weiss, 2018). By using this approach, one of the above mentioned studies (Gartner et al., 2014) has compared the structure of personality on different lineages of felids. Additionally, some of them have found interesting correlations in captive felids related with welfare, management and breeding (see Gartner, 2017 and Gartner & Weiss, 2013b, for a review). To name but a few: in Scottish wildcats higher subjective well-being is associated with the high end of the personality dimension Self Control (Gartner & Weiss, 2013a); while in cheetahs it has been observed that the personality profiles of individuals in successful breeding pairs were more divergent than those of individuals in unsuccessful pairs (Chadwick, 2014); also that non-breeders cheetahs scored significantly higher on the component Tense-fearful than breeders (Wielebnowski, 1999) or that those cheetahs that were reproductively successful scored higher on the component Unsociable, as well as displayed higher fecal glucocorticoid metabolite levels (Razal et al., 2016), among others. Nevertheless, to our knowledge, no research has been carried out on the influence of personality on reintroduction success in felids, despite the fact that 38 of the 40 species of felids are included in the list of endangered animals (International Union for Conservation of Nature [IUCN], 2019). Likewise, no long-term and context consistency research on felids has been carried out on behavioral differences among individuals of the same species, which is consistent with the definition of personality in animals (Gosling, 2001; Réale et al., 2007). Thus, more felid personality research is

needed, to understand the causes that generate and maintain individual differences, as well as the outcomes on welfare and conservation for the species (Gartner & Weiss, 2013b; Powell & Gartner, 2011; Wilson et al., 2019).

Our goal was to assess the personality structure of the Iberian lynx (*Lynx pardinus*) by using a questionnaire based on adjectives previously used within the same biological family: the felids. Additionally, we compared our results with previous ones on wild felids, in order to assess if different behavioral and ecological adaptations could play a role in the evolution of their personality.

Methods

Sample and Study Site

We studied 58 Iberian lynxes' ranging in age from 3.20 to 11.24 years (M = 6.07 ± SD = 1.76 years). The Iberian lynxes were distributed over three Iberian Lynx ex situ Conservation Programme facilities: El Acebuche Captive Breeding Centre (9 females and 9 males; 9 wild-caught and 9 captive-born) Huelva, Spain; La Granadilla Breeding Centre (9 females and 12 males; 2 wild-caught and 19 captive-born) Zarza de Granadilla, Spain and National Centre for Captive Breeding of the Iberian Lynx (9 females and 10 males; 4 wild-caught and 15 captive-born) Silves, Portugal.

Each facility kept individuals in seminatural outdoor enclosures ranging from 550 m^2 to 1000 m^2 in size. The enclosures had natural substrate and mixed Mediterranean vegetation and allowed visual, auditory, and olfactory stimuli. Animals were fed a balanced diet, consisting largely of farm-bred live rabbits or rabbit carcasses, live quail, or raw beef meat and supplements. All facilities are under the same standardized guidelines established by the Iberian Lynx conservation Breeding Programme.

Questionnaire

The personality questionnaire was based on previous felid personality surveys mentioned above. The total number of adjectives was 43, with a Likert rating scale of 1 to 7 (Likert, 1932). We used the synonym-antonym evaluation, whereby the antonyms were deduced from the adjectives used in the previous studies (e.g., aggressive-pacific). Thus, according to the degree to which the adjective described the animal, the evaluation came closer to one pole or the other. In most cases the trait was defined by one adjective for each pole, but in some cases, additional adjectives were included in order to clarify the definition of the trait. The questionnaire was filled out in Spanish. The English version of the questionnaire can be found in the supplementary materials.

Raters

Questionnaires were completed by 12 raters from Acebuche (6 keepers, 5 video-observers and 1 veterinarian), 9 raters from Granadilla (5 keepers and 4 video-observers) and 9 raters from Silves (6 keepers, 2 video-observers and 1 veterinarian). The lynxes of each facility are remotely monitored by a continuous video surveillance system. The animals' behavior is being carefully observed by a round-the-clock video-surveillance system, which provides a great deal of information on the subjects. Thus, knowledge of all raters (including behavioral video-observers, keepers and veterinarians) are mainly based on video-surveillance system with an observation average of 40 hours per week. Knowledge of animals ranged from 1 to 7 years (M=4.8 ± SD = 4.21). All of the raters were working in their respective facility at the time of rating and all of the raters from each facility evaluated all the subjects in their facility. Raters were instructed to base their judgments on general impressions of the lynxes, not on frequency estimates of past behaviors. Raters were asked to avoid discussing their answers with others completing the surveys.

Analysis

All analyses were carried out using IBM SPSS 23, unless otherwise noted.

Inter-Rater Reliability of Items

The reliability was assessed using two intraclass correlation coefficients (ICCs): ICC(3,1) which estimates the reliability of individual ratings and ICC(3,k) which calculates the reliability for the mean scores of the raters, in our case, based on an average of 10 raters per Iberian lynx (Shrout & Fliess, 1979). Items that were not reliable, defined as having an ICC(3,1) and/or and ICC(3,k) less than or equal to zero will be omitted from further analyses. Moreover, to ensure a high degree of interrater reliability, we chose to be conservative and we have also decided to omit items with an ICC(3,k) <0.6 from further analyses.

Data Reduction: PCA and REFA

To determine the components underlying ratings, we first transformed our data into z-scores. By using a principal components analysis (PCA), we examined the scree plot and used parallel analysis (Horn, 1965; O'Connor, 2000) to determine the number of components to extract. We then subjected those components to an orthogonal rotation (varimax) for the factor extraction and to an oblique rotation (promax) for the factor intercorrelations. The factor scores were unit-weighted, and thus the items with salient loadings (defined as absolute value $\geq .40$) were assigned weights of + 1 or – 1 (depending on whether the loading was positive or negative), while items with no salient loadings were assigned weights of 0. Unit-weighted scores are more generalizable across studies and are highly correlated with differentially weighted scores (Gorsuch, 1984). In addition, we conducted regularized exploratory factor analysis (REFA), a technique designed for small sample sizes (Jung & Lee, 2011; Jung

& Takane, 2008). For this analysis, we used quartimax rotation for the factor extraction and specified unweighted least squares for factor extraction. As REFA provides more conservative factor loadings than those obtained via PCA, we defined loadings ≥ .30 as salient.

Cross-Species comparisons

We compared the personality structure of our study sample with previous felid personality structures by visual inspection.

Results

Inter-Rater Reliability of Items

The ICCs for the single (3, 1) and average (3, k) ratings were strong, indicating that raters tended to agree in their judgments about the personality traits of the Iberian lynxes. The mean ICC (3,1) was .37 (SD = .13; range = .16–.64). The mean ICC (3, k) was .84 (SD = .08; range = .65-.95). There were no adjectives with negative ICC values or with ICC (3,k) estimates below 0.6 to be excluded from further analyses. The strength of agreement among raters remained above acceptable levels (k>0.6; Fleiss, 1971). The interrater reliabilities of all 43 items are presented in Table 1.

Data Reduction: PCA and REFA

An examination of the scree plot for the mean ratings of the 58 Iberian lynxes suggested four principal components, and the parallel analysis (Horn, 1965; O'Connor, 2000) indicated that the eigenvalues of the first four components exceeded the 95th percentile of eigenvalues expected by chance. Therefore, a PCA with varimax rotation was used to extract four components. The analysis indicated appropriate sampling adequacy (Kaiser–Meyer–Olkin measure = .90) and the four-factor solution explained

the 56.65 % of the total variance (First factor = 21.13%; second factor = 15.34%; third factor = 10.13% and fourth factor = 10.05%).

We extracted four factors from the mean ratings of the 58 Iberian lynxes using REFA and subjected these factors to a quartimax rotation. From the 43 adjectives analyzed, only *predictable* did not have salient loadings in any factor from both PCA and REFA, while *jealous* did not have salient loading in PCA. In the cases in which adjectives had two salient loadings, the item was interpreted as belonging to the component with the highest loading. Labeling of the factors was based on the pattern of factor loadings and on previous labelling in felid personality research. Thus, we labelled the factors as: Neuroticism, Dominance, Impulsiveness, and Attentiveness (Table 2). The dimensions extracted by REFA and those extracted by PCA were highly comparable, with correlations showing statistical concordance (Table 3). From the four components extracted, the promax rotation produced quite weak correlations, with absolute interfactor correlations ranging from .04 to .18, and with a mean of .11 (Table 4).

Origin, Age and Sex Effects

We tested for the effects of origin (wild or captivity), age [adult (3-6 years), mature (7-10 years) or senior (>11 years)] and sex, using a general linear model with Type III (SAS Institute, 1999). There was a significant main effect of origin on Impulsiveness factor ($F(1.37) = 12.159$, $p < .001$, $\eta^2 = .25$). Post hoc Scheffe's tests revealed that Impulsiveness was higher for those Iberian lynxes caught in the wild than for those in captivity ($M_{diff} = 9.14$, 95% CI = 7,55-10.72). No other age, sex and origin effects were found.

Discussion

In order for a personality research to be useful, the assessment must be both reliable and valid (Freeman & Gosling 2010; Gosling 2001; Gosling & Vazire 2002). The agreement between ratings is measured by reliability. The mean value of reliability for the animal personality studies is .52 (Gosling, 2001). In our case, the overall reliability for the mean ratings of the 43 items was .84, indicating that raters agreed in their assessment on the Iberian lynxes personalities (Table 1). The validity refers to the ability to measure personality in animals (Gosling, 2001; Meaguer, 2009), and is expressed with convergent and discriminant validity (Campbell & Fiske, 1959). On one hand, convergent validity indicates the presence of correlation between measures of two traits that are theoretically related, such as a personality score and a behavior, that are both expressions of a latent variable e.g., "aggressiveness" (Pederson et al., 2005). However, in absence of external measures to compare, it can also be estimated by using the magnitudes of the item loadings onto the factors to which they are assigned (Ferketich et al., 1991; Figueredo et al., 1991). From the 43 items evaluated in the PCA, 38 loaded with values superior to .50, 3 loaded with values between .50 and .40, and 2 of them (*predictable* and *jealous*) did not have salient loadings on any of the factors, even though the ICC values were high (Table 2). Therefore, the overall pattern of factor loadings indicates good convergent validity. On the other hand, discriminant validity indicates the lack of correlation between measures of two traits that are theoretically unrelated, such as a personality and a behavior correlation that is not consistent with the personality factor meaning (Pederson et al., 2005). Nevertheless, in absence of external measures to compare, it can also be estimated by the factorial independence obtained with the low intercorrelation values of the oblique factors (King & Figueredo, 1997). In our case, the mean absolute value is .11, with no relatively high

values (Table 4). Thus, our study showed adequate reliability and validity values, similar to previous animal personality studies (King & Figueredo, 1997; Konečná et al., 2012; Manson & Perry, 2013; Weiss et al., 2006, 2011).

We label our factors following the pattern of factor loadings obtained and on the labels of previous research on felids. Although our study uses adjectives previously assessed in other studies on felids, when we compared our results with previous factorial structures obtained in the group, we did not find any clear pattern of similarities among them (Table 5). Nevertheless, it should be taken into account that we are comparing species from different lineages within the Felidae family. The Panthera lineage (which includes lion, tiger, snow leopard and clouded leopard) split from a common ancestor 10.8 million years ago and the Felids lineage (which includes domestic cat and Scottish wild cat) appeared 3.4 million years ago. Thus phylogenetically, the research on personality structure closest to the Lynx lineage (whose ancestors split from the common ancestor 7.2 million years ago) that we encountered is the cheetah (which belongs to Puma lineage which arose 6.7 million years ago) (O'Brien & Johnson, 2007). Since all the adjectives used for rating personality in cheetahs (Chadwik, 2014; Razal et al., 2016; Wielebnowski, 1999) were included in our study with Iberian lynxes, we can do a comparison between these two species. Keeping this in mind, even if the adjective loadings on to the factors and the label of the factor are not identical between both species, it is worth noting that they present certain similarities. For instance, the Neuroticism factor in Iberian lynx could be similar to Insecure, Tense and Fearful factors for cheetahs. Similarly, the Dominance factor could be related with aggressive behaviors and friendliness with conspecifics for cheetahs, while Impulsiveness factor in Iberian lynx could be related to aspects

associated with insecurity and excitability for cheetahs. Finally, the Attentiveness factor in Iberian lynx could be similar to Active and Excitable factors for cheetahs.

The wide range of differences in personality structures between Iberian lynxes and cheetahs (as well as with the remaining compared species) could be due to (a) ecological and (b) methodological issues.

On one hand (a), if we compare our results with the phylogenetically nearest species (cheetahs), both belong to different lineages that present behavioral and ecological differences. For example, the Iberian lynx is solitary (Ferreras et al., 1997), while male cheetahs will either be solitary or form a group with other males (generally 2 or 3) (Caro & Collins 1987). Additionally, despite its activity during daytime, the Iberian lynx is mainly crepuscular and nocturnal (Beltrán, 1988), while cheetahs are mainly active during the day, but they can also be active at night (Hayward & Slotow, 2009). The Iberian lynx is a specialist predator, feeding almost exclusively on wild rabbits (*Oryctolagus cuniculus*) (Delibes, 1980; Palomares et al., 2001), while cheetahs are more generalist (Bisset & Bernard 2007; Farhadinia et al., 2012; Marker-Kraus et al., 2003). Moreover, the Iberian lynxes prefers to live in the Mediterranean scrubland (Palomares et al., 2000), although rocky areas with some scrubland can also be suitable (Fernández et al., 2006). Meanwhile, cheetahs are more generalist since they inhabit open, grassy savanna plains and dry bush, scrub and open forests, and can also be found in semi-desert areas (Bissett & Bernard, 2007). Thus, the differences in personality found between Iberian lynxes and cheetahs could be due to the fact that they belong to different lineages, as a result of the adaptation to different ecological challenges.

However, it should be mentioned that even amongst the studies of cheetahs that use the same list of adjectives, there are not many similarities among studies (see Table 5). Despite that, a previous comparative personality research on five species of felids

(Gartner et al., 2014), found great similarities even between different felid lineages, with different behavioral and ecological adaptations. Therefore, it is not clear if the differences in personality between Iberian lynx and cheetah (as well as with the other compared species) could be attributable to the fact that they belong to different lineages. On the other hand (b), we could consider methodological challenges as a reason for the differences found. It should be considered if the sample type is playing a role in the assessment of personality. At this point, it should be remembered that the Iberian lynxes rated in this study, belong to a breeding program for the reintroduction into the wild, while the compared species mainly belong to zoos, but also to shelters and breeding centers for captivity. This aspect leads to two main consequences. The first is related with the fact that felids are adversely affected by captivity (Lyons et al., 1997; Manteca, 2009), so the environmental differences could affect their functioning. Since the facilities of the Iberian lynxes, hosted by the *ex situ* Conservation Program, resemble to the natural habitat and respond to the behavioral needs more than zoos and other facilities, these could play a role in the behavior of the animals and consequently on their personalities. The second consequence is based on different knowledge of the animals. Unlike the other studies on felids, raters' knowledge of the Iberian lynxes is not based on direct contact with the animals, but on observations through a continuous video surveillance system. Although video observation provides a great deal of information on the subjects by continuous behavioral data collection, this could affect the lynxes raters' perception compared to other felid raters that have direct contact with the animals. In fact, and as a consequence of this, all the aforementioned studies included in their questionnaires items related to humans as "Friendly to people", "Aggressive to people" or "Fearful of people", while in our research (since there is no

contact between humans and lynxes), all the items related to humans have been deleted, and only those related to conspecifics maintained.

Thus, in light of the diversity of aspects that could condition differences in personality found between Iberian Lynx and other felid species, more felid personality research is needed.

We have found that wild-caught lynxes scored higher on Impulsiveness factor than captive-born. In felids it has been found, that domestic cats and snow leopards have been rated as less Impulsive as they age and female African lions have been rated as more Impulsive than males (Gartner et al., 2014). However, because of the lack of any systematic study that assesses the impact of origin on felids, any comparison to previous results with felids is not possible. In any case, our finding does not come as a surprise, since captive-born animals may decrease the range of behaviors that enable response to a variable and unpredictable environment (McPhee, 2004), while wild-caught could present higher Impulsiveness because is related to boldness that is a large component of an individual's fitness (Réale et al., 2007; Smith & Blumstein, 2008).

Our research showed adequate reliability and validity values, and the sample size and number of raters is higher than in previous felid personality research (Gartner & Powell, 2012; Gartner & Weiss, 2013a; Gartner et al., 2014; Philips & Peck, 2007; Razal et al., 2016; Wielebnowski, 1999). However, as in previous research on felid personality, it would be interesting to assess convergent validity of Iberian lynx personality by searching for correlations with behavioral ratings (Baker & Pullen, 2013; Gartner & Powell, 2012; Pastorino, Paini et al., 2017; Pastorino, Viau et al., 2017; Razal et al., 2016; Wielebnowski, 1999), psychological constructs (Gartner & Weiss, 2013a) or hormones (Razal et al., 2016), among others. The Iberian Lynx is listed as

Endangered by the IUCN (Rodríguez & Calzada, 2015), so it is subjected to a very selective and careful breeding and reintroduction programme (Delibes et al., 2000; Vargas et al., 2008). In this sense, personality has been shown to have an influence on success on breeding in some species (Carlstead et al., 1999; McKay, 2003; Mutzel et al., 2013; Powell et al., 2008), where in the case of felids, non-breeder cheetahs were found to score significantly higher on tense-fearful factor than breeder cheetahs (Wielebnowski, 1999). Likewise, it has been found that personality plays a role on successful reintroduction in some species (Allard et al., 2019; Haage et al., 2017; McDougall et al., 2006; Silva & Azevedo, 2013; Stratton, 2015; Watters & Meehan, 2007). In absence of examples on felids, the swift foxes (*Vulpex velox*) boldness was related with early death after the reintroduction of captive-bred animals (Bremner-Harrison et al., 2004), while with the Tasmanian devils (*Sarcophilus harrissii)* boldness was related with higher survival rates (Sinn et al., 2014). Therefore, more research is needed on the influence of personality on breeding and reintroduction of endangered felids, in order to select the more adequate couples for successful breeding or the individuals with higher survival rates after reintroduction. This kind of research could be crucial for conservation outcomes of one of the most endangered carnivores in the world: the Iberian lynx (Rodríguez & Calzada, 2015).

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674 **Table 1**

675

676 *Inter-Rater Reliabilities of Adjectives*

677

Adjective	ICC(3,1)	ICC(3,k)
Active	.44	.89
Affectionate	.35	.85
Aggressive	.59	.94
Aimless	.23	.75
Anxious	.42	.88
Bullying	.37	.86
Calm	.28	.79
Constrained	.21	.72
Cool	.33	.83
Cooperative	.32	.82
Curious	.48	.90
Decisive	.47	.90
Deliberate	.50	.91
Depressed	.34	.84
Distractible	.25	.77
Dominant	.55	.93
Eccentric	.39	.86
Erratic	.21	.72
Excitable	.31	.82
Fearful	.61	.94
Friendly	.38	.86
Grumpy	.47	.90
Impulsive	.52	.92
Independent	.18	.69
Individualistic	.25	.77
Insecure	.58	.93
Jealous	.18	.69
Mellow	.47	.90
Persevering	.26	.77
Playful	.53	.92
Predictable	.23	.75
Quitting	.19	.71
Reckless	.36	.85
Smart	.16	.65
Solitary	.49	.91
Stable	.29	.81
Stingy	.36	.85
Suspicious	.42	.88
Tense	.31	.82
Timid	.64	.95
Trusting	.60	.94
Vigilant	.26	.78
Vocal	.39	.86

Table 2

Factor Loadings Obtained for Iberian Lynxes

	Principal Component Analysis				Regularized Exploratory Factor Analysis			
	Neu.	Dom.	Imp.	Atten.	Neu.	Dom.	Imp.	Atten.
Timid	**-.89**	-.06	.07	-.01	**-.90**	-.06	.09	-.01
Fearful	**-.86**	-.13	.19	-.09	**-.86**	-.13	.21	-.10
Trusting	**.82**	-.06	-.14	-.03	**.80**	-.06	-.15	-.03
Decisive	**.79**	.13	-.07	.13	**.77**	.13	-.09	.13
Impulsive	**.78**	.04	.33	-.05	**.78**	.05	.32	-.05
Insecure	**-.78**	-.12	.22	-.02	**-.76**	-.12	.23	-.03
Suspicious	**-.68**	.22	.08	.25	**-.66**	.21	.08	.23
Curious	**.67**	-.17	.03	.20	**.65**	-.16	.01	.19
Deliberate	**-.67**	-.10	-.18	.31	**-.65**	-.11	-.17	.29
Reckless	**.56**	.10	.36	-.29	**.55**	.11	.33	-.27
Vocal	**.54**	-.22	-.01	.00	**.51**	-.20	-.01	.00
Bullying	**.51**	.30	.30	-.14	**.49**	.29	.27	-.12
Cooperative	**.51**	-.43	-.04	-.05	**.49**	-.40	-.04	-.04
Jealous	.39	.19	.23	.00	**.37**	.18	.20	-.01
Grumpy	.11	**.77**	.22	.00	.10	**.75**	.21	.00
Affectionate	.16	**-.76**	.01	-.01	.16	**-.74**	.02	-.01
Mellow	-.25	**-.75**	-.23	-.03	-.24	**-.74**	-.21	-.03
Solitary	-.05	**.74**	.02	-.13	-.06	**.72**	.01	-.11
Friendly	-.04	**-.73**	-.23	.11	-.04	**-.71**	-.22	.11
Stingy	.09	**.66**	-.02	-.16	.08	**.63**	-.01	-.14
Cool	.20	**.66**	-.08	-.10	.19	**.62**	-.08	-.09
Aggressive	.53	**.63**	.29	-.01	.53	**.63**	.27	.00
Dominant	.49	**.56**	.04	.01	.47	**.54**	.03	.01
Playful	.39	**-.55**	.17	.01	.39	**-.52**	.15	.01
Depressed	-.36	**.53**	.18	-.10	-.34	**.50**	.17	-.08
Individualistic	-.12	**.50**	-.31	.18	-.12	**.46**	-.29	.16
Constrained	-.41	**.44**	.13	.03	-.39	**.41**	.12	.03
Independent	-.09	**.44**	-.30	.39	-.10	**.40**	-.28	.34
Excitable	.14	.09	**.81**	.11	.15	.10	**.79**	.11
Calm	.02	.07	**-.79**	-.03	.00	.05	**-.77**	-.03
Tense	-.25	.09	**.74**	.12	-.23	.09	**.71**	.12
Stable	.24	.00	**-.61**	.13	.21	-.01	**-.56**	.12
Anxious	.40	.16	**.58**	-.04	.40	.16	**.54**	-.03
Active	.48	-.25	**.55**	.22	.49	-.24	**.52**	.22
Eccentric	.22	.05	**.55**	-.21	.22	.07	**.50**	-.19
Erratic	-.17	.12	**.51**	-.23	-.15	.13	**.46**	-.20
Predictable	.23	-.08	-.29	.04	.20	-.08	-.24	.04
Vigilant	-.34	.01	.07	**.68**	-.33	.00	.05	**.63**
Quitting	-.13	.16	-.04	**-.66**	-.12	.15	-.01	**-.57**
Distractible	.30	-.02	-.07	**-.63**	.29	-.01	-.04	**-.56**
Smart	-.02	-.07	-.24	**.63**	-.03	-.08	-.24	**.55**
Aimless	-.27	.11	.03	**-.50**	-.25	.11	.05	**-.41**
Persevering	.40	.05	-.11	**.43**	.37	.04	-.12	**.36**

Note. Neu. = Neuroticism; Dom. = Dominance; Imp. = Impulsiveness; Atten. = Attentiveness.

Table 3

Correlations Between P.C.A. and R.E.F.A.

	P.C.A.			
	Neu.	Dom.	Imp.	Atten.
R.E.F.A.				
Neu.	**.97**	.31	.30	.26
Dom.	.30	**.98**	.13	-.18
Imp.	.24	.16	**.89**	-.32
Atten.	-.28	-.23	-.40	**.90**

Note. Neu. = Neuroticism; Dom. = Dominance; Imp. = Impulsiveness; Atten. = Attentiveness.

Table 4

Factor Intercorrelation Matrix for the Factor Obtained

Factor	Neu.	Dom.	Imp.	Atten.
Neu.	-			
Dom.	.04			
Imp.	.16	.14		
Atten.	-.10	-.05	-.18	-

Note. Neu. = Neuroticism; Dom. = Dominance; Imp. = Impulsiveness; Atten. = Attentiveness.

Table 5

Personality Structure Obtained in this Study for Iberian Lynx (according to REFA) Compared to Previous Felid Personality Structures Obtained for: Domestic Cat, Clouded Leopard, African Lion, Scottish Wildcat, Snow Leopard, Cheetah and Tiger

	Iberian Lynx	Domestic Cat[a]	Clouded Leopard[b]	African Lion[c]	Scottish Wildcat[d]	Snow Leopard[e]	Snow Leopard[f]	Cheetah[g]	Cheetah[h]	Cheetah[i]	Tiger[j]
Timid	Neu	Neu	Agr/Ope	Neu	Agr	Neu	Tim/Anx				
Fearful	Neu	---	---	Neu	Agr	---	Tim/Anx	---	Ten/Fea	FeaCon	
Trusting	Neu	Neu	Neu	Neu	Agr	Neu	FriHum				
Decisive	Neu	---	---	Neu	Dom	---					
Impulsive	Neu	Imp	Dom/Imp	---	Agr	Imp/Ope					You
Insecure	Neu	Neu	Neu	Neu	Agr	Neu	Tim/Anx	Ins	Ten/Fea	FeaIns	
Suspicious	Neu	Neu	Neu	Neu	Agr	Neu					
Curious	Neu	Neu	Agr/Ope	Neu	Agr	Imp/Ope	Cur/Pla	Ins	Ten/Fea	Act	You
Deliberate	Neu	---	---	Neu	Dom	---					
Reckless	Neu	Imp	Dom/Imp	Imp		Imp/Ope					
Vocal	Neu	---	Agr/Ope	Imp	Agr	Dom		---	Exc/Voc	Act	
Bullying	Neu	Dom	Dom/Imp	Dom	Dom	Dom					
Cooperative	Neu	Neu	Agr/Ope	---	Agr	Dom	FriHum				
Jealous	Neu	Dom	Dom/Imp	Dom	Dom	Dom					
Grumpy	Dom										
Affectionate	Dom	Neu	Agr/Ope	Neu	Dom	Neu					
Mellow	Dom										
Solitary	Dom	---	Neu	Neu	SelfCo	Dom	---	---	---	FriCon	
Friendly	Dom	---	Neu	Neu	Dom	Dom	FriHum	---	---	FriCon	
Stingy	Dom	Dom	---	Dom	Dom	Dom					
Cool	Dom	Neu	Neu	Neu	SelfCo	Neu					
Aggressive	Dom	Dom	Dom/Imp	Neu	Dom	Dom		Agg	Agg	FeaCon	Agr
Dominant	Dom	Dom	Dom/Imp	Dom	Dom	---					
Playful	Dom	Imp	Agr/Ope	Imp	Agr	Imp/Ope	Cur/Pla	Agg	Exc/Voc	FriCon	You

Depressed	Dom						---				
Individualistic	Dom	Dom	Dom/Imp	Dom		Neu					
Constrained	Dom	Neu	Dom/Imp	Neu	Dom	Dom					
Independent	Dom	Imp	Neu	Imp	Dom	---					
Excitable	Imp	Imp	Agr/Ope	Imp	Dom	Imp/Ope	Tim/Anx	Ins	Exc/Voc	Exc	You
Calm	Imp	Neu	Neu	Neu	SelfCo	Neu	Cal/Sel	---	Ten/Fea	Exc	
Tense	Imp	Neu	Neu	Neu	SelfCo	---	Tim/Anx	---	Ten/Fea	FeaIns	
Stable	Imp	Neu	Neu	Neu	Dom	Neu					
Anxious	Imp	Neu	Dom/Imp	Neu	---	Neu	Tim/Anx				
Active	Imp	Imp	Agr/Ope	Imp	Dom	Imp/Ope	Act/Vig	Act	Exc/Voc	Act	Ext
Eccentric	Imp	Imp	Neu	Imp	Dom	Imp/Ope	Tim/Anx	Ins	Exc/Voc	Exc	
Erratic	Imp	Dom	Dom/Imp	Imp	---	Dom					
Predictable	Atten	Imp	Dom/Imp	---	SelfCo	Dom					
Vigilant	Atten	---	Neu	---	Dom	Imp/Ope	Act/Vig				Ext
Quitting	Atten	---	---	Dom	SelfCo	---					
Distractible	Atten	Imp	Agr/Ope	Imp		Neu					
Smart	Atten	---	Neu	Neu	---	---	---	Ins	Exc/Voc	Act	Agr
Aimless	Atten	---	---	Imp	SelfCo	---					
Persevering	Atten	Dom	---	Neu	SelfCo	---					

Note. Act = Active, Act/Vig = Active/Vigilant, Agg = Aggressive, Agr = Agreeableness, Agr/Ope = Agreeableness/openness, Act/Vig = active/vigilant, Atten = Attentiveness, Cal/Sel = Calm/Self-Assured, Cur/Pla = Curious/Playful, Dom = Dominance, Dom/Imp = Dominance/Impulsiveness, Exc = Excitable, Exc/Voc = excitable-vocal, Ext = Extraversión, FeaIns = Fearful-insecure, FeaCon = Fearful of conspecifics, FriCon = Friendly to conspecifics, FriHum = friendly to humans, Imp = Impulsiveness, Imp/Ope = Impulsiveness/Openness, Ins = Insecure, Neu = Neuroticism, SelfCo = Self-Control , Ten/Fea = tense/fearful, Tim/Anx = Timid/Anxious, You = youthfulness.
Blank space: adjective not used in the study, ----: non loading adjective
[a] Classification from Gartner, Powell and Weiss (2014). [b] Classification from Gartner, Powell and Weiss (2014). [c] Classification from Gartner, Powell and Weiss (2014). [d] Classification from Gartner and Weiss (2013). [e] Classification from Gartner, Powell and Weiss (2014). [f] Classification from Gartner and Powell (2012). [g] Classification from Razal, Pisacane and Miller (2016). [h] Classification from Wielebnowski (1999). [i] Classification from Chadwik (2014) [j] Classification from Phillips and Peck (2007).

718

719