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Ontogeny of personality in roe deer (*Capreolus capreolus*)

par

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English abstract

Personality is often described as individual differences that are consistent across time and context. Numerous traits are often used to characterize personality, such as sociability, aggressiveness, exploration, boldness and neophobia. The existence of personality in the animal kingdom is not yet admitted by the entire research community, and relatively few studies have investigated the ontogeny of personality. This longitudinal study explored if roe deer (*Capreolus capreolus*) exhibited consistent individual differences (personality) in a neophobic situation, and if said personality evolved throughout the years (fawn to adulthood). We conducted a "novel object" test where a novel object was placed in a familiar environment and the behavior of six females was recorded using the "continuous recording" method for 5 minutes. We hypothesized that roe deer would indeed exhibit consistent individual differences and confirm the existence of personality in this species, and that personality would stay consistent across time (fawns and adults would show different personality profiles). Results confirmed hypotheses as individual differences were found to be consistent across time (fawn to adult) and relevant behaviors to neophobia were repeatable. Our results suggest that roe deer have different behavioral profiles that are consistent in their lives in relation to their reaction to novelty.

Key words:, repeatability, neophobia, longitudinal study, novel object test, captivity

French abstract

La personnalité décrit les différences individuelles d'une espèce qui sont cohérentes dans le temps et à travers différents contextes. De nombreux traits sont souvent utilisés pour caractériser la personnalité, tels que la socialité, l'agressivité, l'exploration, l'audace et la néophobie. L'existence de la personnalité dans le règne animal n'est pas encore admise par l'ensemble de la communauté scientifique et relativement peu d'études ont examiné l'ontogenèse de la personnalité. Cette étude longitudinale cherche à déterminer si les chevreuils (*Capreolus capreolus*) présentent des différences individuelles cohérentes (personnalité) dans une situation de néophobie, et si cette personnalité évolue au fil des années (du faon à l'âge adulte). Nous avons effectué un test "objet nouveau" dans lequel un objet nouveau a été placé dans un environnement familier et le comportement de six femelles a été enregistré en continu pendant 5 minutes. Nous avons émis l'hypothèse que les chevreuils présenteraient effectivement des différences individuelles cohérentes et confirmeraient l'existence d'une personnalité chez cette espèce, et que cette personnalité resterait cohérente dans le temps (les faons et les adultes présenteraient des profils de personnalité différents). Les résultats ont confirmé que les différences individuelles étaient cohérentes dans le temps (de faon à adulte) et que les comportements pertinents pour la néophobie étaient répétables. Nos résultats suggèrent donc que les chevreuils ont différents profils comportementaux cohérents dans leur vie en ce qui concerne la nouveauté.

Mots clés: répétabilité, néophobie, étude longitudinale, test objet nouveau, captivité

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1. INTRODUCTION

Human personality has long been studied and researched because of the applied use of the collected knowledge on individual and societal problems. Acknowledging the existence of personality in humans allows us to potentially predict behaviors in a given situation (Ajzen, 2008). Indeed, personality is generally described as a behavioral phenomenon which varies among individuals of a given species, shows consistency over time (repeatability) and across context (stability) (Sih et al. 2004).

Research in different species has shown that not all individuals react the same way to stimuli (Ogden, 2012), highlighting the existence of inter-individual differences that are essential in promoting ecological plasticity in a population (Dall *et al.* 2004; Dingemanse *et al.* 2012) and increasing survival of individuals (Dingemanse & Reale 2005; Hoare *et al.* 2007). Emerging literature suggests that personality may not be an exclusively human behavioral phenomenon, but that it might be present across the animal kingdom (mammals (Ogden, 2012), reptiles (Siviter *et al.* 2017), birds (Kluen & Brommer 2013)). The existence of personality in animals is not widely accepted across the entire research community, which is further complicated because researchers of different research fields use a different terminology. The consequences of this debate include the inconsistency of animal personality description and different terms have been used in literature such as temperament, consistent individual differences in behavior, behavioral syndrome or coping styles (Stamps & Groothuis 2010).

Nevertheless, a parallel has been established between the Five-Factors model (openness, conscientiousness, extraversion, agreeableness, neuroticism or OCEAN model) used to describe human personality, and six common traits used to describe animal personality (Gosling, 2001). This model predicts that individuals in a population will vary along a behavioral gradient/continuum for six traits: explorative/less explorative, shy/bold, neophobic/less neophobic, aggressive/less aggressive, highly sociable/less sociable and proactive/reactive (Réale *et al.* 2007). Some of these traits are usually correlated to life history characteristics such as survival, reproduction, dispersal and population dynamics. Indeed, in the predator/prey context, bolder individuals will more likely explore open areas and therefore increase the risk of being predated or harvested (Smith & Blumstein 2008). In addition, less neophobic individuals may be more inclined to disperse from their original group (Debeffe *et al.* 2014; Smith & Blumstein 2008).

Finally, several traits can be correlated and form more complex behavioral syndromes. For example, a bold individual will generally be more explorative and proactive than a shy individual (Koolhaas *et al*. 1999).

As a consequence of the rapid urbanization and development of anthropogenic activities worldwide, conflicts between human and animal populations emerge more frequently (Marchini, 2014) and bolder individuals can cause damage. Herbivore populations, and ungulates in particular, are known for damaging agricultural lands as well as forests, as there has been a reportedly massive increase in ungulate density in Europe over the last 30 years (Bleier *et al.* 2012). The European roe deer (*Capreolus capreolus*) is the most abundant ungulate species in Europe. Their home range has historically expanded from forests to marshes, grasslands and agricultural lands where they can cause a lot of damage on crops (Burbaitė & Csányi 2009). This demonstrates a fairly good ecological plasticity which has helped this species to rapidly colonize new environments (Jepsen & Topping 2004). As there are economic and ecological aspects linked to the increase of roe deer populations on the territory, it is critical to study the ecological and behavioral trends of this species in order to facilitate the sustainable management of ecosystems and populations (Cutini *et al.* 2015). However, until recent years, there was a clear lack of studies on inter-individual differences in roe deer populations (but see Bonnot *et al.* 2018; Debeffe *et al.* 2015; Debeffe *et al.* 2014), which can reduce the efficiency of management programs, and thus perpetuate conflicts. Studying individual differences in a novel environment and, more precisely, studying the bold/shy traits in this species exposed to novelty can be primordial, as those traits are often correlated with the propensity to disperse to new territories.

The research in the present study had two objectives. First, we examined if roe deer exhibited different personality traits by studying the bold/shy traits in a neophobic situation induced by exposing young deer to new objects, whether mobile or immobile. We wanted to explore if neophobia could help discriminate consistent individual traits in roe deer. Second, we examined whether these individual differences changed over time during the animals' development or if, rather, they remained consistent. We firstly hypothesized that roe deer would indeed exhibit consistent individual characteristics for the shy and bold traits which could confirm the existence of personality in this species. Secondly, we hypothesized that these personality traits tend to be stable for individuals over time (i.e. as fawn and as adult) when confronted to novel objects. This

study would thus allow us to confirm the existence of consistent individual differences over time but not across context for this species, as we focused only on one situation (novel environment).

2. METHODS

2.1. Study site

The INRA (National Agronomy Research Institute) experimental station at Gardouch, located 30 minutes south of Toulouse (France), is the only breeding site in Europe that allows experiments to be conducted on the deer-environment system. Covering an area of about 15 ha, the site hosts around 30 animals distributed between a large partially forested enclosure (4 individuals, free-ranging; natural feeding) and 7 small enclosures in meadows (25 individuals, semi-captive; pelleted food: Arterris cervis engraissement, 16% crude protein, 600 g per individual-day).

2.2. Study organism

The video data were collected in 2015 on a small cohort of 6 captive female roe deer born in the spring of 2012 (Maïs, Mica, Minnie, Molo, Mousse and Mylène), all of them 3-year old at the time of the experiment. Individuals were raised in captivity at the Gardouch site and fed by CEFS (Comportement et Ecologie de la Faune Sauvage) staff and are therefore relatively well used to humans. As deer are wild, fearful animals, difficult to breed and manipulate, taming of individuals for experimental testing was necessary to prevent animals from becoming too frightened, stressed and injured. The studies are preferentially geared towards females, who are usually calmer and more easily manipulated than males.

2.3. Experimental setting : novel object test

The experimental setting consisted of two contiguous enclosures of 80m² delimited and separated by a 2-meter-high opaque fence (using wind breakers), communicating through a manually controlled door (Appendix, Fig.A1). The 6 females were kept in pen #1 (with 2 experimenters) and then individually tested in pen #2. The order of passing was determined by random sampling. A video operator was placed in enclosure #2 at the entrance of the hut, so he was fully visible and accessible to the individuals. The roe deer were accustomed to all those present as well as to the pens. The video data were recorded during seven days from April 30th to June 3rd 2015; for a given day animals were individually exposed to one of the 7 novel objects in pen #2 (Appendix, Table A1). Novel objects included a fire extinguisher, a pigeon shooting stand, cables, an upside-down

plastic box, a T-shaped fence post and a remote-controlled polystyrene rectangle that was mobile in one experiment (moved from left to right) and immobile in another. Every roe deer was videotaped for 5 minutes when confronted with each object, so all behavioral activity within the experimental setting were recorded under the "continuous recording" method.

2.4. Ethogram and video analyses

A behavioral repertoire was established to characterize all exhibited behaviors during the experiment and was used when analyzing the videos (Appendix, Table A2). Videos were analyzed using the BORIS software (Friard & Gamba 2016). Behavior recording started when the roe deer entered the pen #2 and lasted 5 minutes. A total of 42 videos were analyzed (7 videos for each of the 6 individuals). Raw data tables from the BORIS program were later transferred onto Microsoft Excel (2016).

2.5. Data analysis

All data analyses were done using the software R version 3.5.1 (*R Core Team*, 2018).

2.5.1. Behavioral profiles – PCA

All Principle Component Analysis or PCA were done using the *FactoMiner* (Lê *et al.* 2008) and *Rcmdr* packages (Fox & Bouchet-Valat 2019). The determination of behavioral profiles can be made using standardized PCA (Bergvall *et al.* 2011). PCA uses a correlation matrix of given variables to summarize and helps visualize large datasets containing multiple individuals or observations. Using this method, we extracted correlated variables that can indicate behavioral profiles. Working on "standardized" variables (their values are divided by their standard deviation) provides the opportunity that each variable contributes equally to the analysis. The standardized PCA allows to visualize and study correlations between behaviors and to identify homogeneous groups or heterogeneity within individuals. The analysis of the correlations circle and correlation coefficients of the 18 behaviors thus helped us to establish behavioral profiles. Here, we performed two PCA, the first one is "PCA on individuals", that was used to describe the duration of the behaviors displayed by each individual when exposed to all the novel objects (sum of the duration across the 7 trials for each behavior and individual, N=6). The second is "PCA of objects" that was used to examine the duration of the behaviors displayed by each individual when exposed to each object (N=42). We wanted to determine if adding the details of which object is present in the neophobic situation was useful to the interpretation of results. PCA were represented using biplots;

coordinates of individuals and variables are thus not constructed in the same space. Focus is put on the direction of variables but not on their absolute position (individuals on the same side of a given variable have a high value for this variable and vice-versa).

2.5.2. Repeatability

Repeatability confirms stability across time and across context according to the definition of personality, and allows to confirm the existence of personality in a study species (Bell *et al*. 2009). If the behavioral traits studied are not repeatable, it doesn't necessarily mean that roe deer don't have personalities, it simply suggests that in the conditions of this experiment, selected behaviors were not repeatable.

Repeatability of personality was assessed using the *rpt* function from the package *rptr* (Stoffel *et al.* 2017). We reported estimates of repeatability [*R*] and the 95% confidence interval [CI] as well as the p-value [*p*]. Repeatability was first analyzed using all the behaviors taken together. A second repeatability was estimated using the behavioral profile previously defined for each individual and each object by the PCA. The result was obtained by taking the scores of each individual on the first dimension of the "PCA of objects" with all individuals and all objects (Fig.3.), it represented only relevant behaviors related to neophobia. For the first analysis, the duration of behaviors data followed a Poisson distribution (*hist* function). Consequently, data were transformed with the *log* function to closely fit with a Gaussian distribution. For the second analysis, scores of individuals on the first dimension (which corresponds to proactive profiles on the positive end and reactive profiles on negative end) were obtained by extracting results from the PCA analysis.

2.5.3. Power analysis

Power analysis was done using the *pwr.anova.test* function from the *pwr* package (Champely *et al.* 2019). First, we checked the power of our analysis with our current sample size (k=6 individuals, n=7 trials/objects for a significance level of 0.05 and f=0.3 effect size). Effect size allows to determine if a significant value is meaningful. We then estimated how many trials would be needed for 6 individuals to reach for the statistical power analysis to reach 80%, as well as how many individuals would be needed for 7 objects to reach 80% (Table 3).

2.5.4. Ontogeny of personality

Data analyzed by Elisa Chalaud (Chalaud, 2016, same cohort, individuals were 1 year old and were tested in a neophobic context in 2013, M1 internship) were retrieved and compared with data

analyzed here (same cohort, individuals were 3 years old and tested in a neophobic context in 2015) to investigate their consistency in time (Table 4).

2.6. Ethical note

All experiments complied with the ethical standards of animal manipulation as defined by the French laws on animal welfare (Décret n°2013-118).

3. RESULTS

3.1. Behavioral profiles – PCA

3.1.1 PCA on individuals

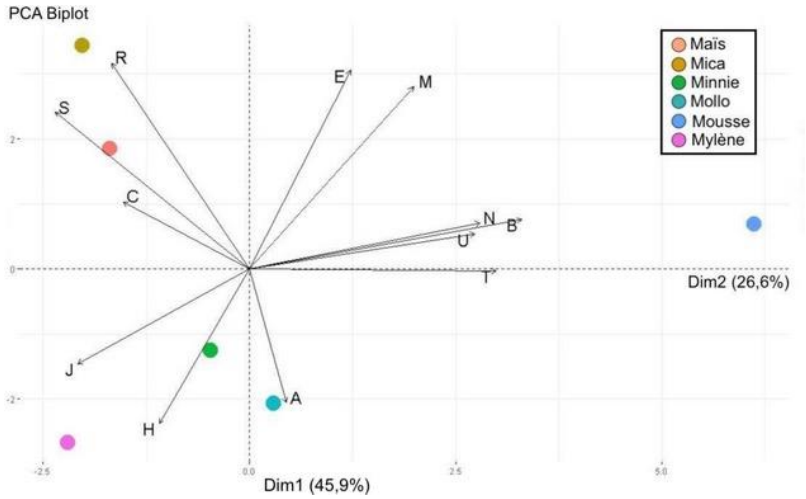

Fig.1.*PCA biplot on all individuals without detail of each object. For behavior identity, see Table.A2.*

PCA were analyzed first to check for the existence of behavioral profiles. First, we used a PCA on all individuals without detailing behaviors for each novel object (Fig.1.). The results showed that Mousse greatly differed from other individuals. Axis 1 explains 45.9% of the variance of the cloud. This axis is positively and strongly correlated with novel object vigilance "U" (correlation coefficient r = 0.75), novel object gaze "N" (r = 0.77), trot or run "T" (r = 0.83) and wind breaker exploration "B" (r = 0.91); and negatively correlated with feed "S" (r = -0.65) and self-centered behavior "C" (r = -0.42). Therefore, Axis 1 captures individual differences in exploratory behavior, opposing individuals who are very vigilant and weary of the novel object on its positive pole and individuals who spend more time ignoring the object and feeding/grooming on its negative pole. Axis 2 explains 26.6% of the variance of the cloud. It is positively correlated with food exploration "E" (r = 0.84), rest "R" (r = 0.87) and walk "M" (r = 0.77). It is also negatively correlated with

novel object contact "H"(r = -0.66), novel object exploration "J"(r = -0.40) and full stop "A"(r = -0.56). Consequently, Axis 2 illustrates the activity of individuals, opposing the reactive individuals who avoid the stimulus and focus on feeding located on its positive end and the proactive individuals located on its negative end who actively seek to interact with the object.Mousse appears to be a particularly active and vigilant individual. Mollo, Minnie and Mylène seem to be very proactive individuals that seek to interact with the object, but also spend more time feeding. Mica and Maïs seem to be the less exploratory individuals and spend more time exploring for food, walking and resting.

As Mousse seemed very different compared to the other individuals, we decided to do another PCA without her data to determine if they were concealing details on the others (Fig.2.). Other individuals showed more differentiated behavioral profiles, which confirms that the data for Mousse concealed details. Axis 1 explains 40.6% of the variance of the cloud. It is positively and strongly correlated with feed "S" (r = 0.79), food exploration "E" (r = 0.83), rest "R" (r = 0.89) and undirected vigilance "V" (r = 0.80); and negatively correlated with full stop "A" (r = -0.67), novel object perimeter "W" (r = -0.95) and novel object/fence zone "Z" (r = -0.97). Therefore, Axis 1 is an indicator of position of the individual in relation to the novel object, opposing individuals who

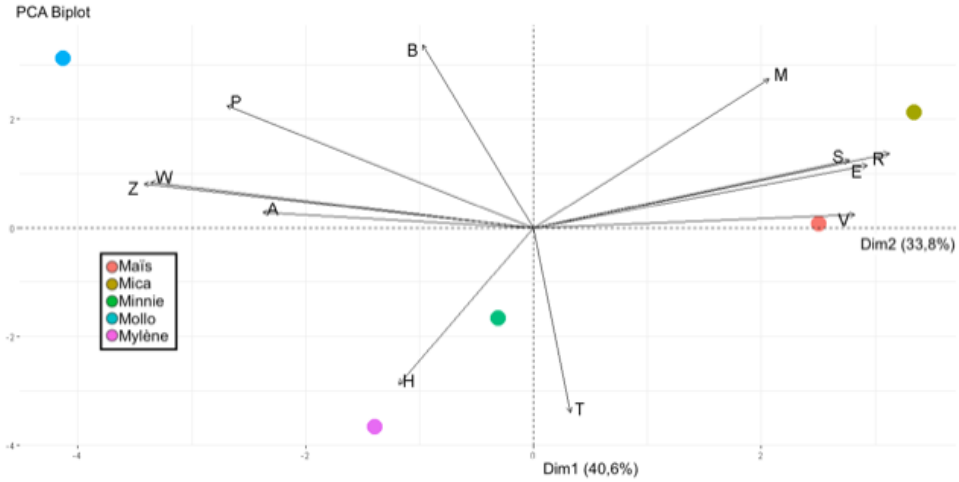

Fig.2.*PCA biplot on all individuals except Mousse without detail of each object. For behavior identify see Table.A2.*

spend more time feeding/grooming away from the object on its positive end and individuals who stay longer in the perimeter around the novel object on its negative end. Axis 2 explains 33.8% of the variance of the cloud. It is positively correlated with wind breaker exploration "B" (r = 0.96), walk "M" (r = 0.78). It is also

negatively correlated with trot or run "T"(r = -0.96) and novel object contact "H"(r = -0.81).

It can be deduced that Axis 2 opposes the calmer individuals who spend more time exploring surroundings on its positive end and very active individuals who interact with the object located on its negative end. Mica and Maïs would thus be less likely to seek interaction with the object. Minnie and Mylène seem spend more time near the object interacting with it. In contrast, Mollo differentiates herself by avoiding interacting with the object at all.

3.1.2 PCA on individuals detailing objects

The following PCA were done to estimate how adding details about the objects themselves adds to the interpretation. First, we did a PCA on all subjects and all objects (Fig.3.). Axis 1 represented a gradient of proactive (positive end) and reactive (negative end) profile. We can see that Mousse has one trial with extreme results on the far right of Axis 1, so we tried to do a second PCA without that trial (the object was "cables", Appendix, Fig.A2.). Results did not differ. We thus decided to remove Mousse to assess whether her behavioral profile concealed details on the others (Fig.4.).

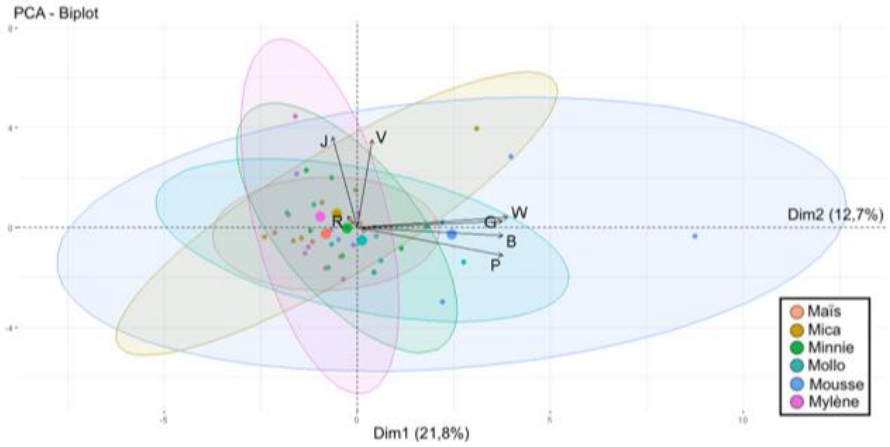

Fig.3. *PCA biplot on all individuals with detail of each objects. For behavior identity, see Table.A2.*

Without Mousse, it seems like Maïs, Minnie and Mylène react randomly to all objects as they don't show any clear behavioral tendencies (Fig.4.). Both Mica and Mollo stand out but it seems to be one extreme value for each, otherwise the ellipses would look similar to the others. This PCA thus shows us that adding detail about the objects is not useful to the study, as the objects themselves don't seem to elicit a clear individual response (fear or interest of the object for all). It is therefore better to interpret results from the previous PCA with all individuals and no detail of the objects (Fig.1. and Fig.2.).

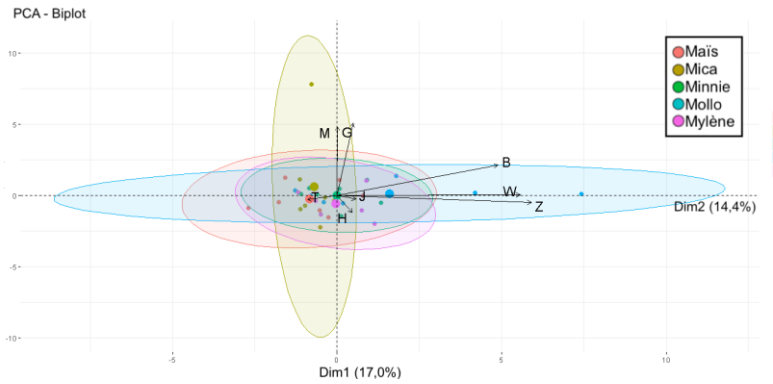

Fig.4. *PCA biplot on all individuals except Mousse with detail of each objects. For behavior identity, see Table.A2.*

3.2.Repeatability

For the first analysis, all individuals' behaviors' durations were not repeatable across the seven trials (R = 0.004, 95% CI [0, 0.014], p = 0.005). For the second analysis, the position of the individual on a reactive-proactive gradient (defined by the PCA using behaviors' durations) were repeatable across the seven trials (R = 0.276, 95% CI [0, 0.592], p = 0.008).

3.3. Power analysis

Table 3.*Results of the power analyses for this study. k=number of individuals, n=number of objects (trials), f=effect size.*

Power analysis	k	n	f	Sig.level	Power
A	6	7	0.3	0.05	**24**%
B	6	**25**	0.3	0.05	80%
C	**55**	7	0.3	0.05	80%

A power analysis was performed to determine the statistical power of the study. Power analysis A revealed that the statistical power of our current study, under sample size and trial constraints was **24%**. Power analysis B revealed that to reach a statistical power of 80%, our study would need to have **25** trials with 25 different objects for 6 individuals. Power analysis C revealed that to reach a statistical power of 80%, with 7 objects (trials), this study would need a sample size of **55** individuals.

3.4. Ontogeny of personality

The same experiment was carried out on the same cohort when individuals were 1 year old and analyzed by Elisa Chalaud during her Master using the same statistical methods we used. She was also not able to determine clear-cut behavioral profiles, only tendencies, which are summarized in Table 4. The bold-shy continuum obtained at 1 year old for this cohort seemed to follow the hierarchy in 2013 (determined by food competition tests), the boldest individual being the most dominant, and the shyest being the less dominant.

Table 4. *Behavioral profile tendencies comparison at 1 and 3 years old in the same cohort.*

Subjects	**1 year old (2013)**	**3 years old (2015)**
Maïs	Bold – low feeding	Shy
Mica	Shy	Shy
Mollo	**Shyest**	**Shyest**
Mousse	Shy	Bold – most vigilant
Minnie	Shy	Bold
Mylène	**Boldest** – low locomotion	**Boldest** – low feeding

4. DISCUSSION

Our study showed that individuals exhibited different behavioral profiles, through our analysis of PCA. Results further revealed that there was very low repeatability when all behaviors without definition of a behavioral profile were analyzed (R=0.004). However, despite low statistical power of the study (24%) due to limited sample size, significant repeatability was found when the analysis represented relevant behaviors to neophobia only (R=0.276). This shows the importance of selecting the right data for repeatability analyses. Individuals were therefore predictable in their behavior; previously identified bolder individuals (with the PCA) that interacted with one object most likely interacted with all, and shyer individuals were consistent in avoiding all objects. Roe deer would thus not behave rigorously identically in different situations but would be coherent in the way they approach novel objects. Nonetheless, results of unpredictability would not necessarily mean that there is no personality. Stamps & Biro 2016 showed that an unpredictable individual could correspond to a new personality profile, one that is extremely plastic to experience and environment, and allows the individual to adapt easily to situations.

Additionally, the existence of personality can only be confirmed if individual differences are consistent across time and context. This study focused on examining consistency across time and not context, as we only used one context (novel object in environment). It is therefore difficult to definitely conclude on the existence of personality in roe deer based on such results. We expected to find that adults would exhibit the same tendencies they did as fawns. The comparison of the behavioral tendencies at 1 and 3 years old showed that personality profiles tended to stay consistent from fawn to adult only for "pronounced" profiles, as the boldest and shyest individuals remained the same and thus individual differences seemed to be consistent over time. Exposure to novelty relates to the notion of danger in an unknown context, where there is a risk of mortality (Koolhaas *et al.* 1999). Behaviors related to this context have therefore been subjected to selection processes. It thus seems logical that behavioral patterns related to neophobia retain their characteristics throughout ontogeny. Interestingly, only two objects elicited reactions from all individuals (see excel table 4) : the fire extinguisher and the plastic box. Both objects are the closest of all objects to the ground, and low height can be associated with small-median sized predators, as they can encounter foxes which can predate on fawns in the wild. In this case, the individual will investigate and could potentially attack (especially if it is a mother with a fawn) (Jarnemo, 2004). This ecological relevancy of height could potentially explain why those objects were the ones to elicit a stronger reaction from all individuals.

Regarding population management, this study showed that individuals are predictable and consistent in time in how they handle novelty. Management programs can thus estimate if populations are composed of bolder or shyer individuals overall. As boldness can be correlated with dispersal, “shy populations” would thus be less likely to colonize new territories than “bold populations” and management strategies could then be more efficient. Moreover, roe deer are territorial animals and the existence of bolder individuals could contribute to the natural management of roe deer population density, as they would be more inclined to disperse if the population gets too large.

It should be noted that several biases exist in this study. Firstly, when subjects were individually tested, they were subjected both to novel environment but also isolation context because they are raised as a group since birth. This can however be nuanced; when young, this isolation bias would be stronger as they are more accustomed to being in a group. But roe deer ecology shows that

adults tend to become more independent, reducing the isolation bias. Secondly, because they are raised together, there can be group-effects on usually shyer individuals. Indeed, allelomimetic behavior reflects the increase of probability of performing a behavior if other individuals from the group are also doing it (Gautrais & Deneubourg 2007).That means that a normally shy deer in our experiment would become bolder because of the group effect. Furthermore, shyer roe deer in the group were also the less dominant ones in 2013. One could think that being in a group can reassure the timid individual which can help it overcome situations it would never be in otherwise, but the existence of this hierarchy can also mean than shyer individuals in neophobic situations have an additional stress due to being submissive. It would thus be relevant to study group effects on neophobic behavior. Finally, the low statistical power of the study is problematic, it might be interesting to repeat the study with a larger sample size or more objects. One must be careful when designing a novel object test however, as the notion of novelty might require objects not to be repeated. Indeed, when using a large number of objects, individuals might become accustomed or habituated to novelty as it is. It is very promising to see that despite all of the previously mentioned biases, a significant repeatability for the proactive-reactive scores was found for this small cohort.

4.1. Conclusion

The findings of our longitudinal study of the existence and ontogeny of personality in roe deer exposed to a novel object context show a time consistency of distinct behavioral profiles. It would be interesting to do this study in a way that increases statistical power, by adding for example more individuals or novel objects/repeating them (although there is a risk of habituation to novelty). It would also be interesting to study the same cohort in different contexts from neophobia, which is what is currently being done at the CEFS (i.e. an isolation context at same age stages).

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Appendix

Table A1. *Novel objects characteristics.*

Date	Novel object	Mobility
30/04/2015	Fire extinguisher	Immobile
05/05/2015	Cables	Immobile
13/05/2015	Upside-down plastic box	Immobile
14/05/2015	Pigeon shooting stand	Immobile
18/05/2015	T shaped fence post	Mobile
01/06/2015	Remote controlled polystyrene rectangle	Mobile
03/06/2015	Remote controlled polystyrene rectangle	Immobile

Table A2. *Ethogram of behaviors exhibited during the experiment.*

Key	Code	Description
M	Walk	Individual walks at normal gait
A	Full stop	Individual stops
O	Walk toward object	Individual walks at normal gait towards novel object AND looks at it
G	Walk along fence	Individual walks at normal gait along the fence closest to the novel object
T	Trot or run	Individual trots or runs
R	Rest	Individual lays down
V	Undirected vigilance	Individual is immobile, head high and only the ears move, gaze not toward object
S	Feed	Individuals feeds on the ground or ruminates
E	Food exploration	Individual sniffs the ground (walk or stop)

B	Wind or wind breaker exploration	Individual sniffs the air or wind breakers (walk or stop)
P	Door exploration	Individual sniffs or licks the door (walk or stop)
C	Self-centered behavior	Individual scratches itself with head or legs, shakes (stop)
U	Novel object vigilance	Individual is immobile, head high and only the ears move, gaze toward object
N	Novel object gaze	Individual looks at object
J	Novel object exploration	Individual sniffs object at most a meter away
H	Novel object contact	Individual touches or licks object
W	Novel object perimeter	Individual is near object
Z	Novel object/fence zone	Individual is between the fence and the object

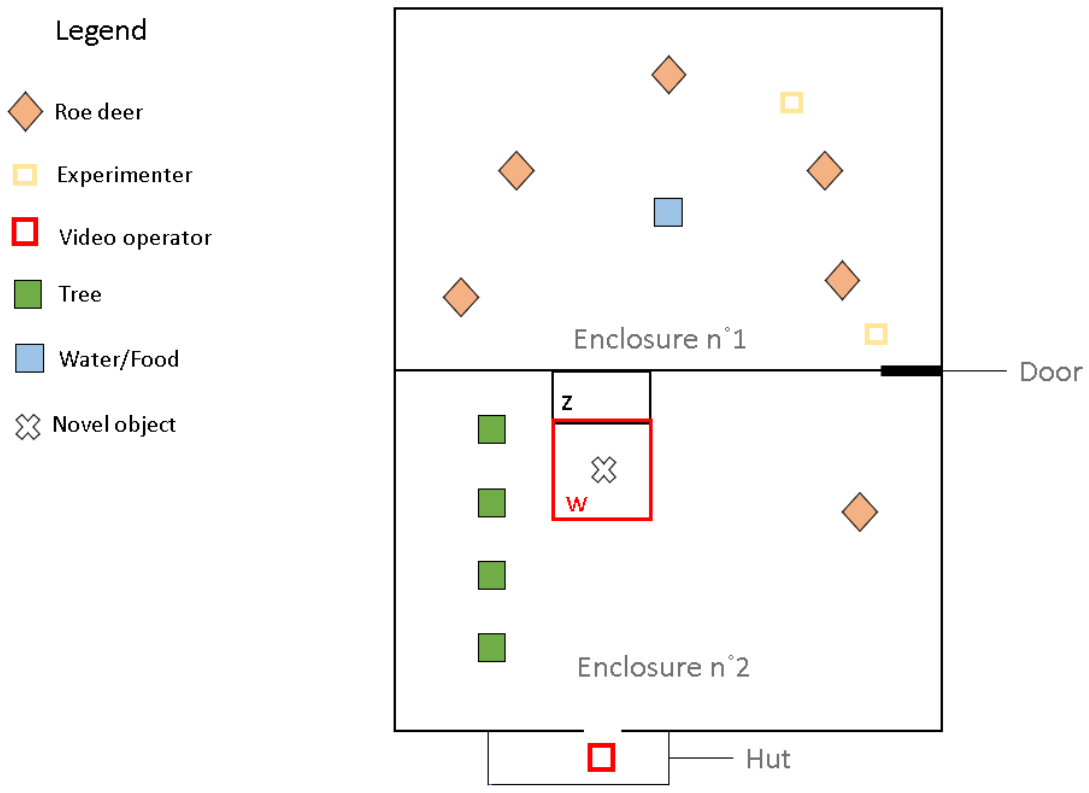

Fig. A1. *Scheme of the experimental setting.*

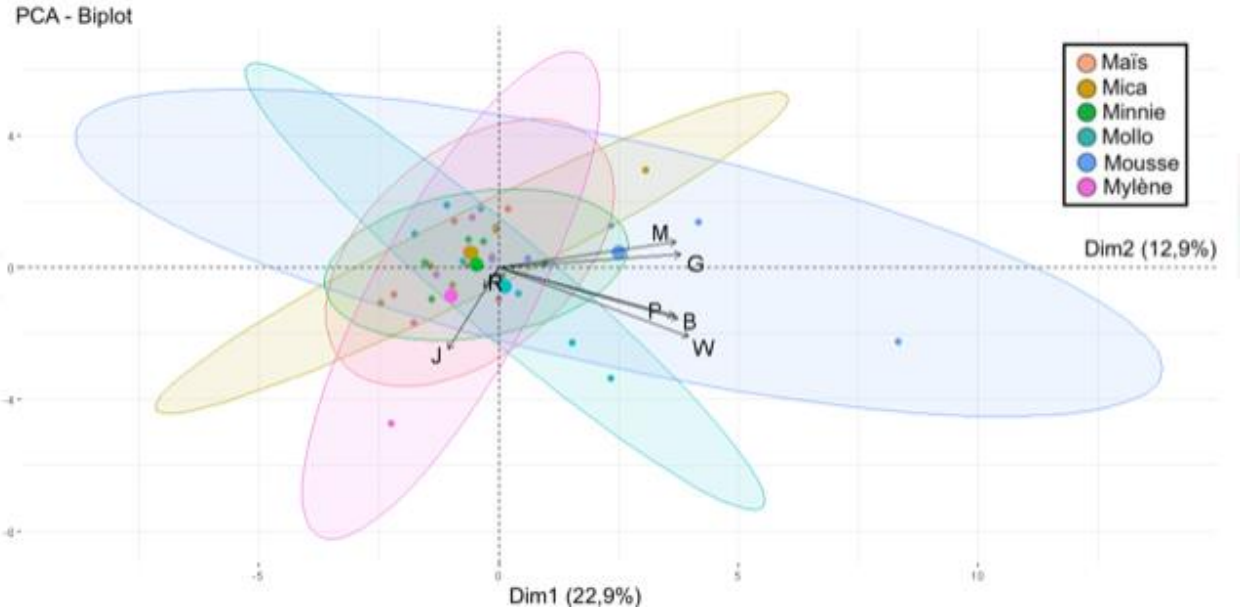

Fig.A2. *PCA biplot on all individuals with detail of each objects except "cables". For behavior identity, see Table.A2.*