How do you feel about wildlife? Understanding the role of emotions in discrete choice experiments for valuing wildlife conservation

1. Introduction

When valuing environmental goods with stated preferences the level of willingness to Pay (WTP) might be influenced by a large number of factors. In the literature, it has been highlighted the role of socio-demographic characteristics on WTP levels, such as gender, age, education and income, as well as knowledge of the non-market good and individual experience with it (Johnston et al., 2017). All these observable characteristics of the individual have been proved to play a role in preference formation and in explaining individual choices.

More recently, some researchers have focused their attention on individual emotions. In the behavioural and psychological literature there is evidence that emotions affect the individual decision-making process (Blanchette and Richards, 2010; Lerner et al., 2015), including the formation of preferences for public and environmental goods. As suggested by Hanley et al. (2017), the issue of stated preference changes due to changing emotions is relevant, as it adds an element of context-dependence in field surveys. Cost-benefit analysis (CBA) is based on the assumptions that (1) individuals make rational choices and that (2) preferences are stable and consistent (Hanley & Barbier, 2009). In the presence of context-dependence CBA measurements might be biased and their interpretation difficult. However, humans often do not make rational decisions, particularly in highly emotionally issues (Zajonc, 1980) such as those concerning human-wildlife interactions (Hudenko, 2012).

Only few papers have investigated the effect of emotions on stated choices so far. Araña and Leon (2008) examined the relationship between emotions and anchoring in a contingent valuation survey and found this effect to be relevant but coherent. The same authors (Araña and León, 2009) investigated also the effects of sadness and disgust in a laboratory setting and found they had a heterogeneous role in the compensatory rule, i.e. in trading-off all attributes to determine the alternative with the highest utility. Hanley at al. (2017) explored the role of emotions on WTP in a lab experiment, in which students were asked to make choices on alternatives for beach recreation in New Zealand. Authors induced happiness and sadness by means of short video clips before the survey to two treatment groups. They found no effects of incidental emotions on estimated parameters and WTP levels. Notaro et al. (2018) investigated the role of emotions on tourists' willingness to pay for the Alpine landscape in a choice experiment survey. They asked respondents to self-assess their emotional state at the time of the survey. Results showed that people with negative emotions have higher levels of preferences and willingness to pay for a qualitative increase in landscape compared with people with positive emotions. In general, the effect of the emotional state at the time of the data collection on preference formation is still ambiguous.

With this in mind, the aim of this paper is to explore the effect of induced emotions on the variation in stated preferences elicited with a Choice Experiment for wildlife conservation. This approach is in line with the new directions in the area of environmental and conservation phycology that call for greater attention on how emotions influence human behaviour to contribute to conservation (Bennett et al., 2017) and particularly for models that integrate emotion for understanding decision making in human-wildlife conflict (Hudenko, 2012).

The choice experiment aimed to elicit preferences for changing sizes of populations for wolves (*Canis lupus*), lynx (*Lynx linx*) and a subspecies of salamanders (*Salamandra atra aurorae*) in a case study in the Italian Alps. Wildlife may produce different emotions on individuals, in particular large carnivores such as wolves and lynx may induce fear and affect the level of WTP (Johansson et al., 2012; Zimmermann et al., 2001). For this reason, we decided to test the effect of inducing a sentiment of fear and one of assurance to two subsamples of respondents and control if they have an effect on estimated coefficients and on the level of WTP. Differently from previous SP contributions, we implemented a field on-site survey in which emotions were induced to respondents using pictures as emotional stimuli. An image of an angry and scary wolf was used to induce fear in a first treatment, while assurance was induced by using a picture of a calm and assuring wolf in a second treatment. The only difference in the two treatments was the picture showed to respondents. We focused on integral emotions, emotions arising from a decision at hand (Lerner et al., 2005). We tested two main ways in which emotions might affect choices. The first is that WTP might change when emotions are induced to respondents. People assigned to the fear treatment should be less willing to pay compared to the control group for a given size of wolves' population. Conversely, people in the assuring treatment should be willing to pay at least the same amount of money (or more) of the control group for a given size of populations of the carnivores. We included the salamander to understand whether the treatment has a specific effect on predators or towards wildlife in general. The second effect to study is whether the effect of the treatment is maintained for the entire length of the survey or it decreases as the questionnaire progresses.

2. Materials and Methods

2.1 Emotions and their measurement

In the psychological theory emotion is any mental experience with high intensity and a high degree of pleasure or displeasure (Cabanac, 2002). Emotions have four components: physiological responses (e.g. increase in heartbeat); facial expressions (e.g. flocking); behavioural responses, such as "attacking or escaping" and experiential components, as being fearful (Bradley and Lang, 2000).

Emotions can be classified in two different perspectives: discrete emotions and emotional dimensions. The discrete perspective considers different emotions, such as fear, joy, anger and disgust (Ekman and Friesen 1971, Izard, 1992; Izard 2007) while the dimensional perspective evaluates emotions along a spectrum of valence and arousal (Barrett, 2006; Russell, 2003). Valence indicates a dimension of pleasure-displeasure towards an object or a situation, while arousal activation or deactivation with respect to a stimulus.

Emotions can be divided, at least conceptually, into two different but connected aspects: emotional dispositions and states (Jacobs et al., 2012). Emotional dispositions may indicate both emotionally charged personality traits (Digman, 1990), as a general tendency to be happy or sad, and the criteria with which the emotional relevance of the stimulus is judged (Frijda, 1986). Emotional dispositions are always present in individuals, they are relatively stable and have a certain degree of abstraction. Emotional states are temporary, involve the activation of a feeling and can vary greatly in intensity from person to person and depending on the situation (Jacobs et al., 2012). While emotional dispositions are mental traits, they show "*who you are*", emotional states reflect “*how you are*”, how a person stands and feels (Hamaker et al. 2007).

Four major categories of response systems are available in the literature to measure emotions: physiological measures, brain activity measures, behavioural measures, and self-reported measurements (Mauss and Robinson, 2009). Physiological measures include heartbeat, pressure, breathing, body temperature, and pupil diameter and are registered with specific instruments while brain activity are measured with electroencephalogram and magnetic resonance imaging. Behavioural measures are facial expressions, tone of voice, and posture of the body, that can be detected through direct observation of respondents, or more recently with the help of computer programs (Cohn and Kanade, 2007). Finally, self-assessment measures allow capturing emotions by asking questions to respondents. “Self-reports of emotion are likely to be more valid to the extent that they relate to currently experienced emotions” (Mauss and Robinson, 2009, p. 213). In this contribution, we explored emotional states activated with a stimulus using self-assessment measures.

2.2 Emotions in decision-making

Insights from behavioural science and psychology suggest that emotions influence actual choices and behaviours (Lerner et al., 2015). In particular, the literature suggests three ways through which decision-making could be affected by emotions (Rick and Loewenstein, 2008). First, the individuals may anticipate the future emotion they will feel after a decision and choose the outcome providing the highest positive emotion. A second way derives from the feeling arising from a decision at hand, i.e. integral emotions. For example, if a choice is perceived as risky then the individual could exhibit fear. Finally, decisions could be affected by incidental emotions, i.e. emotions at the moment of the decision but irrelevant for its payoffs (Hanley et al., 2017).

Along the decision making process, affect heuristic bring the emotional response into play. Heuristics are mental unconscious shortcuts that help us make decisions and judgements quickly. Individuals make predictable errors in decision making due to the use of heuristics. Affect heuristic behaves as a first and fast response mechanism in decision-making, occurring automatically (Zajonc, 1980), and may distort evaluation of risk and benefit of an event. When people have a pleasant feeling about something, they see the benefits as high and the risks as low, and vice versa (Keller et al., 2006; Slovic et al., 2004).

Hence, emotions play a role in decision making through the automatic system of thinking. According to the dual-system theory (Kahneman, 2003) people have two systems of thinking: the reflective system and the automatic system. The first one is deliberate and self-conscious, the second one emotional, instinctive. These two systems jointly interact in a decision making process. The processing that occurs first through the automatic system is then moderated by the reflective system to produce what is presumed to be the “best” decision (Kahneman, 2003; Sloman, 1996). If one environmental factor, even small, excessively activate one system over the other, the behavior can significantly change (Jahedi et al., 2016). The automatic system is highly susceptible to environmental influences (Thaler and Sunstein, 2008), e.g. external stimuli.

There are several examples of experiments in which researchers induced a specific emotion to individuals before they complete a decision-based exercise. Mood induction could be done by means of activities such as watching movies, reading stories or listening to music (Gilet, 2008; Johnson and Tversky, 1983; Westermann et al., 1996). The use of images is also a common way of manipulating emotions and implemented in several psychological and medical studies (to name a few, Heinberg and Thompson, 1995; Hofer et al., 2006; Schneider et al., 1994; Wadlinger and Isaacowitz, 2006; Wang et al., 2005).

In the context of wildlife conservation a large set of emotions may affect individual preferences (Jacobs, 2012). However, when the object of study is the conservation of predators or large carnivores the sense of fear could play a relevant role on individual behaviour (Cozzi et al., 2012; Røskaft et al., 2003; Zimmermann et al., 2001). Arrindell (2000) identifies five sub-categories of fear towards wildlife: (1) towards large predators; (2) towards scary animals such as rats, bats and snakes; (3) towards nonslimy invertebrates (bees, cockroaches etc.…); (4) towards slimy invertebrates (worms) and (5) towards farm animals. In this contribution, we mainly focused our attention on the first category and explored if inducing a mood of fear or, as an antonym, a mood of assurance could have an effect on WTP for conserving large carnivores. We induced fear with an image of an angry and scary wolf, while assurance was induced by means of a calm and assuring wolf. Pictures were shown to respondents just before showing choice cards and maintained visible for the entire set of choices.

2.3 Survey design and administration

Data for this case study originated from a questionnaire survey administrated in Trentino, which is a mountainous province in the Northeast of the Italian Alps. Trentino is an important tourist destination, with around three million tourists per year and a good balance between winter and summer tourists. This area is important for nature conservation, because of the presence of several rare and endangered species. The province includes one national park (Parco Nazionale dello Stelvio), two regional parks (Adamello-Brenta and Paneveggio Pale di San Martino) and several other Natura 2000 sites, occupying 34 percent of the total area. Among several interesting species, this study focuses on tourists' preferences for conserving the wolf (*Canis lupus*), the lynx (*Linx linx*) and the salamander of Aurora (*Salamandra atra aurorae*), a rare subspecies of the alpine salamander. Wolf and lynx, extinct in Trentino around the end of the 19th century, naturally came back from neighbouring areas, in particular the wolf from the Italian Apennine and the lynx from Switzerland. At the time of the survey, there were seven wolves and only one lynx in the regional area, therefore the population size was not enough to assure the prosecution of the species. The salamander of Aurora, conversely, is a rare amphibious living only in a limited area of the Province with a population of about ten specimens.

The questionnaire was administrated face-to-face in the summer of 2015, by three trained interviewers, to a sample of randomly selected tourists of the province of Trento. Interviewers asked every second tourist they met on-site to participate to the survey. We surveyed tourists because they are the direct users of natural areas and they could potentially encounter wolves or lynx during their outdoor activities. Therefore, recalling a sentiment of fear or assurance is easier for tourist rather than for the local population, which could oppose to carnivores restoration not because of fear but rather due to potential damages to economic activities (e.g. attacks to sheep herds).

The questionnaire was designed following the guidelines for stated CE available in the literature (Riera et al., 2012). The questionnaire was composed by 34 questions, organized in three thematic sections. The first part of the questionnaire included warm-up questions and questions on value orientations and emotions towards wildlife. The second section contained the choice cards; we added a piece of text that interviewers had to read before showing the cards, containing information on the current status of the animals, the content of the cards and the way to answer the questions. We also included a script to ensure consequentiality (Carson and Groves 2007). This script informed respondents that results could be used for policy, so they were asked to complete choice tasks with commitment and thinking as they had to actually pay the amounts they pick. The last section contained socio-demographic questions. A pre-test of the questionnaire was conducted in June 2015, using a sample of 63 tourists, to check wordings and collect priors for an efficient design to use in the main survey. We used the priors to generate a Bayesian efficient design based on the D-efficiency criterion (Bliemer et al., 2008). Respondents had to complete 12 choice tasks, each of which was composed by three alternatives (two efficiently-designed alternatives and a null alternative). The answer format was the Best-Worst, which allows collecting a larger number of observations compared to the traditional pick-one alternative, with only a small increase in the effort for respondents (Louviere et al., 2013). An example of choice task is available in Figure 1. This was the choice card given to the control group.

Figure 1: Example of choice card in the control group

		Scenario A	Scenario B	Scenario C
	**Number of free wolves**	90	30	0
	**Number of free lynx**	0	45	0
	**Number of free salamander aurora**	45	0	0
	Entrance ticket	6 €	12 €	0 €
Choose your most preferred option (mark √)				
Choose your least preferred option (mark √)				

Attributes and attribute levels are available in table 1; non-monetary attributes were the number of animals for wolves, lynx and salamanders. Levels were decided after focus groups with experts of wildlife management, who stated that 40-50 specimen would assure a viable population for wolf and lynx and 90 would be the maximum regional carrying capacity. We recognize that wolves and lynx might compete for food and territory and therefore correlation might occur between these attributes. However, given the size of the study area and the relatively small number of each animal as well as the differences in their preferred prey animals, experts feel that any conflict is likely to be small. In addition, we did not propose management measures to obtain a given size of population, therefore correlation between attributes should not represent a problem for the experiment.[1] The monetary attribute was a ticket to visit protected areas in the region. At present, there is no entrance fee for regional parks but in the province of Trento they have to co-finance activities for wildlife management, therefore an entrance ticket might be an option to increase self-funding.

Table 1: Attributes and levels used in the choice cards

Attribute	Description	Levels
Wolves	Number of wolves	0, 15, 30, 45, 60, 75, 90
Lynx	Number of lynx	0, 15, 30, 45, 60, 75, 90
Salamanders	Number of salamanders	0, 15, 30, 45, 60, 75, 90
Cost	Entrance fee for parks (in €)	0, 3, 6, 9, 12, 15, 18

We suspected a non-linear relationship between WTP and population sizes, because people might be willing to contribute for conservation but, at the same time, they don't want too many animals. To account for this non-linearity, we tested a dummy coding for each level and a quadratic specification of the utility function. The level of log-likelihood was similar in the two models, while the BIC was smaller for the utility function specified in quadratic terms, therefore we used this latter in the analysis. The monetary attribute was linearly coded.

We created two treatments and each treatment was randomly assigned to one fourth of the total sample. The other half of respondents received no treatments and acted as a control group. Globally we assigned the first treatment to 105 respondents, the second treatment to other 105 respondents and the control group was composed by 210 individuals. Treated participants were asked to self-assess their emotional dispositions when thinking about wolves, lynx and salamanders. The participants indicated their degree of fear, joy, anger, disgust and sadness on a 7-point Likert-type scale. Then they were exposed to a picture of a wolf and asked to self-assess their emotional state, on a similar 7-point Likert-type scale. The picture remained visible for the entire length of the choice tasks and included in the choice card, while the control group received no pictures. The first group, which we refer to as *fear-treated group*, received a picture of a snarling wolf with the objecting of inducing fear. The second group, which we conversely called *assure-treated group*, received a picture of a cheerful wolf to stimulate a sentiment of assurance. Pictures used for the treatment are reported in Figure 2. Our

[1] Correlation might occur if, for example, we proposed to increase the size of population through an improvement of the habitat quality. This would cause an increase in the population of the three animals simultaneously. Avoiding this allowed us to have uncorrelated levels for the populations and the relative importance of the three animals for respondents is reflected in the stated WTP.

approach with pictures is similar to the methodology used to test, for example, preferences of zoo visitors towards wildlife (among others, Frynta et al., 2013; Marešová et al., 2009).

Figure 2: Pictures used for the fear (left) and assuring (right) treatments

2.4 Econometric Analysis

Our modelling approach is derived from the Random Utility Model (Manski, 1977), for which the utility that respondent n derive from a certain alternative *i* in the choice situation *t* may be described by the following utility function, linear in the parameters:

$$U_{int} = \beta X_{int} + \varepsilon_{int}$$

Where β is a vector of parameters to be estimated, X_{int} a vector of attributes that describe alternative *i*. Assuming that the error term is i.i.d. extreme value type I distributed, a certain sequence of choices can be modelled with a conditional logit model (MNL), whose probabilities can be calculated as follows (McFadden and Zarembka, 1974):

$$\Pr(i_{nt}|x_{int}, c, \beta) = \prod_{t=1}^{T_n} \frac{e^{\beta_n' X_{ni}}}{\sum_j e^{\beta_n' X_{ni}}}$$

It is well-known that the standard MNL has the limitation of providing a point estimate for each coefficient, which is equivalent to assume preference homogeneity for the entire sample. Such condition is not likely hold, therefore analysists are often concerned in estimating more flexible models that account for taste heterogeneity. In this regard, the mixed logit model (MXL) is frequently used. The MXL assumes that coefficients are individual-specific and follow a random distribution, for which a location and a scale parameter is estimated (Train, 2009):

$$P_{ni} = \int \frac{e^{\beta_n' x_{ni}}}{\sum_j e^{\beta_n' x_{ni}}} \varphi(\beta|b,\Omega)d\beta$$

In which $\varphi(\beta|b,\Omega)$ is the probability density function of the distribution of the coefficients. In environmental applications, it is a common practice to assume normally distributed coefficients. In our Best-Worst format respondents are asked to state their most (best) and least (worst) preferred alternatives in a set of three alternatives *J*, say j_1, j_2,and j_3 in each of the twelve choice task t. We assume that each respondent choose his/her most preferred alternative *j* in each of *J*-1 sequential choice tasks (i.e., j_1 as first best and j_2 as second best), each containing one alternative less than the previous choice task. As the best-worst approach allows us to retain two choice-observations from each choice task we estimate our models by using the "exploded" parametric mixed logit model (Luce and Suppes 1965; Scarpa et al. 2011), whose probabilities are computed as the product between the probability of the best choice and that of the second best:

$$P_{ij}[ranking\ j_1, j_2, j_3] = \int \frac{e^{\beta_n' x_{nij_1}}}{\sum_{j=j_1,j_2,j_3} e^{\beta_n' x_{nij}}} \times \frac{e^{\beta_n' x_{nij_2}}}{\sum_{j=j_1,j_2} e^{\beta_n' x_{nij}}} \varphi(\beta|b,\Omega)d\beta$$

When a cost attribute is included in the utility function, WTP for non-monetary attributes can be calculated in terms of marginal rate of substitution. The usual way to calculate WTP is to use the negative ratio between non-monetary coefficients and the cost coefficient. However, we used a slightly different formula because of the quadratic coding of attributes that allows estimating WTP for any given size of animal populations:

$$WTP_i = \frac{(\beta_i \times N_i) + (\beta_i \times N_i^2)}{\beta_{cost}}$$

In the MXL model, assuming a normally distributed coefficient for the cost attribute complicates the estimation of the WTP, because it would lead to a ratio between two normal distributions, with no finite central moments. For this reason, we assume a fixed cost coefficient to allow WTP estimation. We estimated WTP for different sizes of animal population using the Krinsky-Robb procedure with 5,000 draws (Krinsky and Robb, 1986).

3. Results

We collected 24 observations per respondent for a total of 10,080 observations that were used in the analysis. Treated groups have 2,520 observations each, while the control group 5,040. Respondents were on average 43 years old and females accounted for the 53.3 percent of the sample (males constituted the remaining 46.7 percent). Most of respondents had a high school degree (41 percent), while the share of respondents with a university degree was around 37 percent. The median annual net income bracket €10-20 thousands. Descriptive statistics of the sample are similar to the average regional tourists.[2]

Respondents in the two treatments showed similar levels of fear for wolves before they were presented the pictures (table 2). This means that in our sample our average respondent has a similar emotional disposition of fear with respect to wolves. This level of emotion is maintained after having looked at the scary picture (i.e. the difference between the mean of emotional disposition and emotional state is not statistical significant). The presentation of the reassuring image instead has significantly reduced the feeling of fear experienced when thinking of wolves.

Table 2- Descriptive statistics of fear toward wolves: emotional disposition and state

Fear	Fear treatment		Assurance treatment		
	Mean	Stand Dev	Mean	Stand Dev	P-value*
Disposition	3.35	1.86	3.12	1.89	
State	3.50	2.02	1.77	1.92	< 0.0001
P-value*	0.50		< 0.0001		

*Mann-Whitney Test

Table 3 displays statistics of the econometric models. It can be noticed that the MXL model performs better for all the groups, as the LL and R^2 are higher. The R^2 increases roughly three times from the MNL to MXL, suggesting a better fit of the data. This indicates that there is relevant preference heterogeneity for wildlife conservation across individuals. For brevity and to allow a clearer understanding we present only results of the preferred MXL models in table 4.

Table 3: Statistics of the econometric models

	CONTROL		ASSURANCE		FEAR	
Model	MNL	MXL	MNL	MXL	MNL	MXL
LL	-2627	-2050	-1282	-907	-1408	-1093
R2	0.24	0.63		0.67		0.61

As expected from economic theory, the cost coefficient is negative, suggesting decreasing marginal utility at higher price levels. The coefficient for the null alterative (ASC) is also negative, which is an indication that respondents prefer contributing to actions for the conservation of the three animals. All animal species show a positive coefficient for the linearly coded number of animal and negative for the squared coefficient; only the coefficient for the squared number of salamanders turns positive in

[2] A detailed description of regional tourism in Trentino (including tourists' profile) can be found at the following link:
http://www.turismo.provincia.tn.it/binary/pat_turismo_new/report_andamenti_stagionali/REPORT_turismo_trentino._Rapporto_2015.1457448319.pdf

the assuring treatment, but it is statistically not significant. The negative coefficient for the quadratic coding suggests that utility for larger population increases up to a maximum and then decreases. This result was expected, because people could be willing to pay to restore viable population but, at the same time, they do not want too many specimens as they might cause problems to the environment and exacerbate social conflicts. In the model for the *assure-treated group* the coefficient for the wolf is larger than the coefficient for the control group. This means that for this treated group utility increases more for larger populations of wolves. On the other hand, the coefficient for the number of wolves in the *fear-treated* group and the control is similar but still lower than in the group treated with the assuring picture. The coefficient for lynx follows a similar trend, with the coefficient in the *assure-treated* group larger than that of the *fear-treated* group.

Table 4: results of the MXL models for treated and control groups

	CONTROL		ASSURANCE		FEAR	
Attributes	**Coefficient**	**t-test**	**Coefficient**	**t-test**	**Coefficient**	**t-test**
Wolf	.061***	9.1	.088***	7.97	.065***	7.11
Wolf2	$-.600 \cdot 10^{-3}$***	-10.75	$-.85 \cdot 10^{-3}$***	-8.39	$-.72 \cdot 10^{-3}$***	-8.48
Lynx	.054***	7.35	.069***	5.68	.063***	5.94
Linx2	$-.55 \cdot 10^{-3}$***	-7.66	$-.69 \cdot 10^{-3}$***	-5.85	$-.59 \cdot 10^{-3}$***	-5.74
Salamander	.021***	3.1	$0.89 \cdot 10^{-3}$	0.09	.019**	2.01
Salamander2	$-.170 \cdot 10^{-3}$***	-2.63	$0.11 \cdot 10^{-3}$	0.99	$-.19 \cdot 10^{-3}$**	-1.99
ASC	-7.414***	-8.16	-8.89***	-6.25	-5.400***	-6.25
Cost (fixed)	-.0985***	-8.97	-.153***	-8.31	-.113***	-7.04
sd_Wolf	.0190***	8.05	.0226***	4.54	.024***	7.83
sd_Wolf2	$.428 \cdot 10^{-4}$	0.51	$.200 \cdot 10^{-3}$***	3.64	$.712 \cdot 10^{-4}$	0.97
sd_Lynx	.011***	5.02	$.900 \cdot 10^{-2}$**	2.43	.015***	5.63
sd_Lynx2	$.496 \cdot 10^{-4}$	1.05	$.35 \cdot 10^{-04}$	0.76	$.121 \cdot 10^{-4}$	0.2
sd_Salamander	.022***	9.48	.029***	7.2	.021***	6.76
sd_Salamander2	$.107 \cdot 10^{-4}$	0.2	$.442 \cdot 10^{-04}$	0.73	$.82 \cdot 10^{-4}$*	1.66
sd_ASC	5.386***	9.81	6.72***	7.32	5.147***	8.19
Obs	5040		2520		2520	
Respondents	210		105		105	
log_L	-2050		-907		-1093	
McFadden's R2	0.63		0.67		0.61	

Salamanders have the smallest contribution to the utility function of tourists, as their coefficients are the lowest in all models. This trend is in line with previous research suggesting that people are on average more willing to pay for charismatic species and mammals conservation rather than for reptiles (Colléony et al, 2017; Martín-López et al., 2008).

Most of the standard deviations for population sizes are statistically significant, which is an indication that sample preferences are heterogeneous.

Table 5: Interaction with the card number

	ASSURANCE		FEAR	
Attributes	Coefficient	t-test	Coefficient	t-test
Wolf	.128***	8.63	.070***	5.45
Wolf2	$-.155\cdot10^{-2}$***	-8.18	$-.75\cdot10^{-3}$***	-4.86
Lynx	.03219**	2.46	.06138***	5.05
Linx2	$-.34\cdot10^{-3}$***	-2.77	-.00057***	-4.91
Salamander	$0.37\cdot10^{-3}$	0.04	.020**	2.15
Salamander2	$-0.12\cdot10^{-3}$	-1.18	$-.21\cdot10^{-3}$**	-2.18
Wolf * card	-10.47***	-7.72	-5.68907***	-5.36
ASC	$.13\cdot10^{-3}$***	4.86	$.615\cdot10^{-5}$	0.27
Cost (fixed)	-.20612***	-9.21	-.11349***	-6.33
sd_Wolf	$0.782\cdot10^{-2}$	1.06	.02240***	6.78
sd_Wolf2	$.23\cdot10^{-3}$***	4.54	$.44\cdot10^{-4}$	0.46
sd_Lynx	$0.277\cdot10^{-2}$	0.54	.01620***	5.57
sd_Lynx2	$.405\cdot10^{-4}$	0.179	$.67\cdot10^{-4}$	0.85
sd_Salamander	.026***	7.21	.01978***	5.89
sd_Salamander2	$.923\cdot10^{-4}$	1.32	$.52\cdot10^{-4}$	0.88
sd_ASC	7.49***	7.33	5.25***	7.01
sd_Wolf * Card	$.278\cdot10^{-2}$***	4.36	$0.72\cdot10^{-3}$	0.87
log_L	-895.8		-1092.6	
McFadden's r2	0.68		0.61	

Table 5 presents only the treated groups, with an interaction variable between wolves and the number of choice card answered. This might help understanding if the effect of the pictures is maintained during the tasks or not. It can be seen that the coefficient is negative and statistically significant for both groups therefore the effect of the picture decreases during the choice exercise. This result is coherent with the behavioural literature: emotions seem to have influenced the automatic system of thinking, but their effect declines as the reflective system moderates the automatic one.

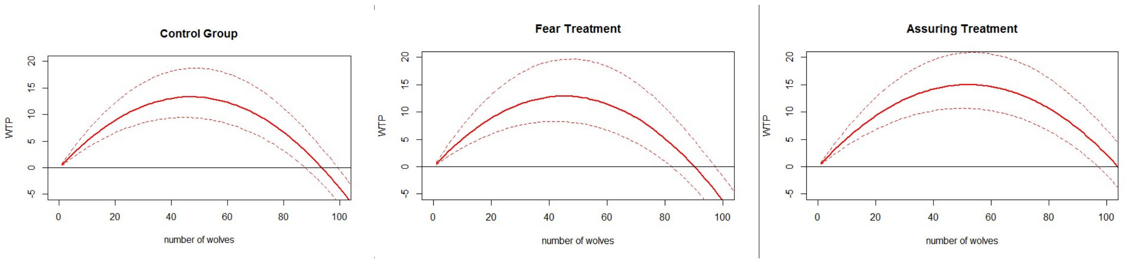
Table 6: Krinsky-Robb WTP (in €) for different sizes of animal population

Pop. size	10	20	30	40	50	60	70	80	90
				Control group					
Attribute									
Wolf	5.18 (3.75–6.94)	9.13 (6.58–12.25)	11.85 (8.43–15.99)	13.32 (9.36–18.14)	13.56 (9.32–18.73)	12.56 (8.29–17.73)	10.33 (6.27–15.23)	6.86 (3.21–11.17)	2.15 (-1.11–5.87)
Lynx	5.01 (3.42–6.92)	8.88 (6.04–12.29)	11.61 (7.87–16.13)	13.20 (8.89–18.40)	13.66 (9.11–19.20)	12.99 (8.52–18.52)	11.17 (7.12–16.17)	8.22 (4.75–12.37)	4.14 (1.40–7.29)
Salamander	1.97 (.81–3.32)	3.58 (1.47–6.02)	4.85 (2–8.15)	5.76 (2.39–9.69)	6.32 (2.65–10.68)	6.53 (2.65–11.08)	6.38 (2.43–11.02)	5.89 (1.91–10.56)	5.04 (0.98–9.68)
				Assure-treated group					
Wolf	5.31 (3.82–7.07)	9.49 (6.79–12.68)	12.55 (8.93–16.82)	14.47 (10.25–19.54)	15.28 (10.69–20.79)	14.95 (10.23–20.61)	13.49 (8.88–19.08)	10.91 (6.55–16.21)	7.20 (3.17–11.99)
Lynx	4.14 (2.54–5.79)	7.36 (4.67–10.64)	9.67 (6.10–13.99)	11.05 (6.93–16.03)	11.52 (7.13–16.77)	11.07 (6.73–16.27)	9.70 (5.68–14.48)	7.41 (3.99–11.51)	4.20 (1.54–7.37)
Salamander	0.16* (-.82–1.25)	0.46* (-1.32–2.45)	0.90* (-1.51–3.61)	1.48* (-1.38–4.77)	2.21* (-1.02–5.92)	3.08* (-.44–7.18)	4.10* (1.32–8.53)	5.25* (1.32–10.09)	6.55* (1.32–11.92)
				Fear–treated group					
Wolf	5.23 (3.45–7.48)	9.17 (5.99–13.16)	11.80 (7.63–17.08)	13.13 (8.28–19.23)	13.16 (7.95–19.62)	11.89 (6.69–18.33)	9.32 (4.36–15.37)	5.45 (0.98–10.80)	0.28 (–3.85–4.91)
Lynx	5.23 (3.23–7.78)	9.38 (5.79–14)	12.46 (7.69–18.59)	14.47 (8.92–21.61)	15.41 (9.46–32.02)	15.28 (9.33–22.83)	14.07 (8.49–21.08)	11.79 (6.91–17.91)	8.45 (4.41–13.35)
Salamander	1.56 (0.23–3.18)	2.78 (0.39–5.70)	3.65 (0.45–7.61)	4.18 (0.37–8.87)	4.36 (0.24–9.51)	4.19 (-.11–9.59)	3.67 (-.67–8.99)	2.81 (-1.51–8.12)	1.60 (-2.84–6.80)

*WTP statistically not different from zero

Table 6 shows WTPs for wolves, lynx and salamanders estimated for the two treated groups and the control. The trend for wolves and lynx is similar, as the WTP increases for larger population sizes up to 50 specimens and then it decreases. WTP for salamander has a similar trend only in the control and in the fear-treated groups, although the maximum is reached in the presence of 60 salamanders. In the assure-treated group WTP always increases with larger sizes but it is not statistically significant. Concerning wolves, it can be noticed that average WTP for all population sizes in the assure-treated group are systematically larger than the control group ones, while WTP of the fear-treated group are lower than the control. Differences become larger as the population size increases with the fear group reaching zero WTP at lower levels of animals that the assurance and control groups (figure 3).

Figure 3: Krinsky-Robb confidence intervals for WTP for conserving wolves, in fear and assuring treatment and control group.



* The continuous lines represents the mean marginal WTP, while dashed lines the lower and upper borders of the confidence interval, estimated at a confidence level of 95 percent. Confidence intervals are calculated through the Krinsky-Robb method, using 5,000 draws (Hole, 2007).

Turning the attention to WTP for lynx it can be noticed that the trend is different. In fact, in this case the assure-treated group shows the lowest WTP, while the fear-treated group has average WTP larger than the control. Lastly, salamanders show the lowest WTP in absolute terms and the control has larger figures compared to both treated groups for populations up to 80 specimens.

Table 7: p-values of the t-test used for differences in the mean WTP among groups

Wolves				**Lynx**				**Salamanders**			
					Population: 40 animals						
	Control	**Assur.**	**Fear**		**Control**	**Assur.**	**Fear**		**Control**	**Assur.**	**Fear**
Control	-			**Control**	-			**Control**	-		
Assur.	0.000	-		**Assur.**	0.000	-		**Assur.**	0.000	-	
Fear	0.002	0.000	-	**Fear**	0.000	0.000	-	**Fear**	0.002	0.000	-
					Population: 50 animals						
	Control	**Assur.**	**Fear**		**Control**	**Assur.**	**Fear**		**Control**	**Assur.**	**Fear**
Control	-			**Control**	-			**Control**	-		
Assur.	0.000	-		**Assur.**	0.000	-		**Assur.**	0.000	-	
Fear	0.000	0.000	-	**Fear**	0.000	0.000	-	**Fear**	0.000	0.000	-
					Population: 60 animals						
	Control	**Assur.**	**Fear**		**Control**	**Assur.**	**Fear**		**Control**	**Assur.**	**Fear**
Control	-			**Control**	-			**Control**	-		
Assur.	0.000	-		**Assur.**	0.000	-		**Assur.**	0.000	-	
Fear	0.000	0.000	-	**Fear**	0.000	0.000	-	**Fear**	0.000	0.000	-

We tested whether the treatments had an influence on respondents' choices with t-tests on the empirical distribution of WTP for the three animals, estimated using the Krinsky-Robb procedure (Krinsky and Robb, 1986). We show in table 7 the p-values of paired t-tests. We focus our attention on population sizes of 40, 50 and 60 animals because this range may assure a viable population of these species in the future.[3] The null hypothesis is that mean values are equal while the alternative is that mean WTPs are different. It can be noticed that the p-values are all close to zero and lower than 0.01, therefore the null hypothesis of equality of means is rejected at 1% confidence level.

4. Discussion

The behavioural literature suggests that emotions might have an impact on individuals' rationality and affect choices (Rick and Loewenstein, 2008). This aspect is of high importance in non-market valuation because it introduces an element of context-dependence on individual choices, which violates the hypothesis of preference stability and bias WTP estimates for Cost-Benefit Analysis.

In our study we aimed to understand whether emotions have an influence on stated preferences and WTP for wildlife conservation. Results of our analyses confirm that the treatments had affected choices and the related WTP for wolves, lynx and salamanders. The pictures of a scary and an assuring wolf had a direct effect on the WTP for wolves, with the assure-treated people being more willing to pay for conserving the wolf compared to the control group and the fear-treated group less willing to pay. This effect was not entirely evident in the self-assessment of emotions. While respondents in the assure-treated group reported lower levels of fear after having looked at the picture, those in the fear-treated group seem not to be affected by the scary picture. On average, they reported the same level of fear both in the question on emotional dispositions and emotional states. The scary picture instead affected their answers to the CE. At the same time, the treatments had an indirect effect on WTP for the other two animals. WTP for lynx had an indirect trend compared to the WTP for wolves, with the fear-treated group more willing to pay for lynx conservation than the control and the assure-treated group less willing to pay. A possible explanation for this result is that the fear-treated group had a sentiment of aversion towards wolves that lead respondents to trade fewer wolves for larger population of lynx, while the assure-treated group were lead to prefer wolf conservation as it is a more 'iconic' species compared to the lynx (Ericsson et al., 2008). The positive attitudes towards lynx is confirmed from other studies (Bartczak and Meyerhoff, 2013), for which lynx are usually not perceived as threatening (Balčiauskienė and Balčiauskas, 2001). Concerning salamanders, average WTP for their conservation was found to be lower for both treated groups compared to the control. The effects of the treatments are also visible in the coefficient for the null alternative. The fear-treated group shows the smallest coefficient in absolute value, indicating that the disutility of not protecting all the three animals is lower for this group compared to the other two groups. Conversely, the assure-treated

[3] Results of the tests for different sizes returned similar results and are available upon request.

group has the largest negative coefficient for the null alternative, suggesting that this group has a large disutility from not preserving the three animals.

Our study obtained similar results to those of Notaro et al. (2018), Araña and León (2009) and Araña and León (2008) because, although the focus of these papers were slightly different, it confirms that emotions might affect individual decision-making. Despite the mainstream behavioural literature indicates that emotions influence almost all situations of individual choices (Lerner et al., 2015), this topic is only little explored in the environmental field and evidences are still ambiguous. For example the paper by Hanley et al. (2017) found no effect of manipulating emotions such as sadness and happiness on preferences for beach recreation. They concluded that choices over public goods, whose benefits are shared by many, might not be as sensitive to emotions as private goods. The different nature of the goods evaluated in our and their study might explain why treatments have a different effect on the results. Wildlife conservation has a public utility but it might also have a direct consequence on the tourists' recreational experience. For example, if tourists were afraid that increasing the population of wolves might increase the likelihood of being attacked while hiking in the woods they might choose not to pay for an increase in the size of wolf population. Further, in our study we explored integral emotions - emotions related to the object of the study, i.e. wildlife -, whereas the previous cited studies explored the effect of incidental emotions.

5. Conclusions

The present study analysed the effect of emotions on stated preferences for wildlife conservation. For this purpose, two treatments involving manipulation of emotions were assigned to two sub-groups of respondents, while a control group had no treatment assigned. Results indicate that emotions had a significant effect on preferences and individual WTP for conserving the wolf, lynx and salamanders. Specifically with respect to the assuring treatment, there is a statistically significant effect on the utility associated with the wolf population, suggesting that members of this group are more likely to accept a larger wolf population. Conversely, people assigned to the fear treatment have lower preferences for conserving the wolf. These differences are reflected in differences in willingness to pay for conservation. These results confirm the behavioural literature for which emotions affect the higher levels of cognitive process and the related decision-making.

The significant effect of induced emotions identified in this contribution is in line with Notaro et al., (2018), Araña & León (2009) and Araña & León (2008) and suggests that in some cases there is a legitimate concern about context-dependence of preferences. If Discrete Choice Experiments results are influenced by respondents' emotions, the estimation of environmental benefits might be biased.

This is an important issue because reliable DCE results are required to be used in management and decision making, in order to make environmental decisions that satisfactorily represent public goals and preferences.

Given that the literature on this topic is still scarce and some papers indicate opposite results (for example, Hanley et al. 2017), we encourage further research on this topic.

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