THESIS

MESSAGE FRAMES AND WILDLIFE VALUES INFLUENCE PUBLIC ACCEPTANCE OF WILD HORSE MANAGEMENT STRATEGIES

Submitted by

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ABSTRACT

MESSAGE FRAMES AND WILDLIFE VALUES INFLUENCE PUBLIC ACCEPTANCE OF WILD HORSE MANAGEMENT STRATEGIES

Wild horses are a symbol of the American West that evoke emotional responses from people, and the management of these populations has become a contentious issue. We examined the influence of messaging and wildlife value orientations on public acceptance of potential wild horse management actions in the Western United States. We used an online questionnaire that began with one of three randomly assigned messages about wild horse management: the control message provided information about wild horse populations and management options, the rational appeal added on information about the negative impacts of growing wild horse populations and the limitations of current management approaches, and the emotional appeal added a photograph of emaciated wild horses to the rational appeal. The questionnaire then asked participants about their acceptance of wild horse management options and their values of and experiences with domestic horses. Our survey experiment showed that messaging can influence overall acceptance of wild horse management techniques. Participants who received the emotional or rational appeal were more accepting of the use of contraception, sterilization, euthanasia, and the sale of horses to be used for consumption compared to those who received the control. Adding an emotional component to the rational appeal increased acceptance of wild horses living out their lives in government holding pens over all other message conditions. We also found that participants in general were more accepting of contraception and sterilization than any of the other management techniques. Participants with traditionalist values were more likely to accept euthanasia. Overall, we suggest that messaging may influence public acceptance of many of the proposed management actions for wild horses in the Western United States.

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INTRODUCTION

Wild horses (*Equus ferus*) are an iconic symbol of the American West, and for many people just the word "horse" conjures up a multitude of emotions (Scasta, Hennig, & Beck, 2018). The native horse species that originally existed in North America went extinct about 10,000 years ago, and the wild horses in the American West today are descendants of horses introduced by European settlers in the late 15th century (Beever, 2003; Garrott & Oli, 2013; Kirkpatrick, Lyda, & Frank, 2011; Scasta et al., 2018; Scasta, 2019). Wild horse populations are currently growing at a rate of 15-20 percent per year (Michaels, 2018; National Research Council, 2013) in the American West. Scientists suggest that population increases has led to increased pressure on rangelands creating less available forage for horses resulting in increased competition with native wildlife and livestock (Garrott & Oli, 2013; Michaels, 2018; Norris, 2018; Scasta, 2019). These negative ecological and economic impacts have led agencies and organizations to begin considering various management options to control populations of wild horses.

Currently, wild horses are being managed primarily by the Bureau of Land Management in compliance with the Wild and Free Roaming Horses and Burros Act (WFRHBA) (1971), which prompts the agency to protect and manage wild horse and burro populations in their jurisdictions (Garrott & Oli, 2013; Michaels, 2018; Perryman, McCuin, & Schultz, 2018; Wild and Free Roaming Horses and Burros Act (1971)). The BLM and other federal agencies manage wild horse populations primarily by removing horses from public rangeland and placing them into private off range holding facilities. Managing agencies seek to promote adoption of these horses removed from the range. The horses that are not adopted live out their lives in these

enclosures or pastures (Garrott & Oli, 2013; Perryman et al., 2018). For the fiscal year 2018, the BLM used 61 percent of the total budget for the wild horse and burro program on off-range holding costs (about $50 million) (Bureau of Land Management, 2019). In addition to removing horses from the range and placing them in pastures, the BLM currently practices contraception on range to manage population growth rates.

Contraception has been used to manage wild horse populations since the late 1970's and researchers continually seek a safer, more practical, and highly effective method to apply to the overpopulated wild horse herds across the Western US (Kane, 2018). Current contraception approaches include the use of Porcine Zona Pellucida (PZP) immunocontraception vaccines (PZP-22 and Zona-Stat-H) and the GonaConTM vaccine (National Research Council, 2013). These vaccines have been shown to reduce fertility in wild horses but are difficult and costly to implement, because inoculations need to be given frequently and are most effective when hand-injected (Kane, 2018; Kirkpatrick et al., 2011; National Research Council, 2013). Implementing novel management strategies such as sterilization and furthering research for contraception drugs will require building public acceptance of such techniques (Kane, 2018; Kirkpatrick et al., 2011; Scasta, 2019).

Management of free roaming horses on public lands in the western United States creates legal, social, and political challenges for federal agencies (Michaels, 2018; Scasta et al., 2018; Scasta, 2019). Appropriations bills have limited the options that managers can use to curb population growth (Danvir, 2018; Norris, 2018). For example, the Consolidated Appropriations Act (2005) which required the BLM to sell horses older than ten years and the Rahall Amendment (2006) which prevented the sale and slaughter of protected wild horses and burros limit the scope of management possibilities (Danvir, 2018; Norris, 2018). Wild horse

management plans are often plagued by litigation, and during public comment periods, many stakeholders voice concern for horse well-being. Such litigation and stakeholder opposition has often prevented the BLM from implementing alternative management options, such as sterilization or lethal control (Danvir, 2018; Michaels, 2018; Norris, 2018; Perryman et al., 2018; Scasta et al., 2018). Although there is controversy around the use of sterilization and the efficacy of contraception techniques to stabilize population growth rates, studies have shown that these techniques may be promising management options for reducing wild horse populations (Kane, 2018; Kirkpatrick et al., 2011).

Given the social challenges associated with wild horse management, research is needed on whether communication strategies can influence public support for diverse wild horse management options. Previous studies from conservation psychology suggest that carefully crafted and framed messaging to the public has the potential to change attitudes and build support for controversial wildlife management issues (Goldstein, Cialdini, & Griskevicius, 2008; Kidd et al., 2019; Perryman et al., 2018; Steinhorst, Klöckner, & Matthies, 2015; Wolsko, Ariceaga, & Seiden, 2016). Echeverri and colleagues (2017), for example, showed that messages could shape student attitudes toward sea otters and their management as an endangered species. Studies suggest that rational and emotional appeals in particular may be able to change attitudes towards conservation issues (Miller, Freimund, Metcalf, & Nickerson, 2018; Skurka, Niederdeppe, Romero-Canyas, & Acup, 2018; Zinn & Manfredo, 2000). Rational appeals are objective statements of information that can be verified independently (Zinn & Manfredo, 2000). Emotional appeals provide subjective information open to interpretation, such as a photograph that elicits an emotional response (Zinn & Manfredo, 2000). In advertising campaigns, both rational and emotional appeals have been shown to be persuasive (Batra & Ray, 1986), but the

role of these appeals in conservation is still not clearly understood (Zinn & Manfredo, 2000). Research suggests that emotional appeals are more memorable than rational appeals but may not be effective if subjects do not believe the emotional content to be relevant (Zinn & Manfredo, 2000).

In this study, we sought to understand whether, and how, rational and emotional appeals influence public acceptance of various wild horse management options. We also sought to understand how such messaging may influence individuals with different value orientations. Preliminary evidence from Miller et al. (2018) suggests that when messaging is consistent with wildlife value orientation (i.e. pro hunting messaging directed to traditionalists), it is perceived as more relevant. A large body of research suggests that wildlife value orientations - the ideological shaped beliefs that orient and provide meaning to one's values in relation to wildlife (Teel & Manfredo, 2010) - are strong predictors of attitudes towards and support of wildlife management strategies (Bright, Manfredo, & Fulton, 2000; Manfredo, Teel, Sullivan, & Dietsch, 2017; Miller et al., 2018; Teel, Dayer, Manfredo, & Bright, 2005). However, little is known about how messaging and wildlife value orientations interact to influence support for controversial management options. Preliminary evidence from Miller et al. (2018) suggests that when messaging is consistent with wildlife value orientation (i.e. pro hunting messaging directed to traditionalists), it is perceived as more relevant. Furthermore, few studies have examined more broadly how diverse messages influence individuals with different values, attitudes, and demographics (Kidd et al., 2019). Such investigations are crucial to inform the development of targeted outreach campaigns, which could be more effective by targeting certain messages to certain audience segments (Kidd et al., 2019). We sought to address these gaps by examining

how rational and emotional appeals influence support for wild horse management options, and if these influences differ among individuals with different value orientations.

METHODS

Respondents from the sample of individuals who completed a survey for the America's Wildlife Values study (Manfredo et al., 2018) were recruited for this study. A total of 11,343 people participated in the Manfredo et al. (2018) study from the ten western states that have wild horse populations, and 3,207 of those participants included email addresses in their response indicating they would be willing to participate in future studies about wildlife related issues. Recruiting participants from this list allowed the targeting of residents who live in states with wild horse populations. It also allowed survey responses of participants in this study to be matched with their previously reported wildlife value orientation results from the study of America's Wildlife Values (Manfredo et al. 2018).

Aa messaging experiment was conducted in which participants were randomly assigned to read one of three messages (a control message, a rational appeal, or an emotional appeal) discussing wild horse management. The control message provided information about wild horse populations and the debate surrounding management of these species. It did not have any information intended to persuade the audience (Table 1). The rational appeal included the information about wild horse populations from the control and added information about the negative effects of overpopulation on horse well-being, ecosystems, and native fauna and the challenges and limitations to current management approaches (Table 1). The emotional appeal included the same information as the rational appeal and added a picture of an emaciated mare and a foal at the Wheeler Pass HMA in Nevada with a caption that read: "Managers and scientists have reported that in some places, overpopulation is leading to starvation due to the lack of available forage" (Table 1).

Table 1. Messages used in our experiment. Participants were randomly assigned to receive one of these three messages at the beginning of the survey.

Control	Rational Appeal (RA)	Emotional Appeal (EA)
Did you know that there are over 80,000 wild horses and burros in the western United States? These are horses not kept by an owner that live off of available forage on public lands. Wild horses and burros are not native to the United States, but rather, were brought to America by the Spanish. Since then the population of wild horses has increased and is currently growing 15-20% annually. Some people believe that wild horses should not be managed, and nature should take its course, while others believe that the wild horse population should be managed to prevent overgrazing on public lands. Various management options could exist for managing wild horses, including rounding up horses to government holding pen until they are adopted, sterilization, and birth control.	*Did you know that there are over 80,000 wild horses and burros in the western United States? These are horses not kept by an owner that live off of available forage on public lands. Wild horses and burros are not native to the United States, but rather, were brought to America by the Spanish. Since then the population of wild horses has increased and is currently growing 15-20% annually.* Managers and scientists have reported that in some places, overpopulation is leading to starvation due to lack of available forage. In some areas, wildlife like antelope and deer are diminishing, and the land is so overused it is being made unproductive. To reduce the ecological impacts of wild horses where the horses are overpopulated, a federal agency, the Bureau of Land Management, has rounded up 50,000 wild horses into government holding pens and pastures, which are costing the agency nearly $50 million annually. Fewer than 5,000 horses are adopted annually while more than 10,000 are being born each year. Lawsuits have often prevented the BLM from taking actions to further manage the wild horse population using tools such as sterilization, birth control or humane lethal control.	*Did you know that there are over 80,000 wild horses and burros in the western United States? These are horses not kept by an owner that live off of available forage on public lands. Wild horses and burros are not native to the United States, but rather, were brought to America by the Spanish. Since then the population of wild horses has increased and is currently growing 15-20% annually.* Managers and scientists have reported that in some places, overpopulation is leading to starvation due to lack of available forage. In some areas, wildlife like antelope and deer are diminishing, and the land is so overused it is being made unproductive.  To reduce the ecological impacts of wild horses where the horses are overpopulated, a federal agency, the Bureau of Land Management, has rounded up 50,000 wild horses into government holding pens and pastures, which are costing the agency nearly $50 million annually. Fewer than 5,000 horses are adopted annually while more than 10,000 are being born each year. Lawsuits have often prevented the BLM from taking actions to further manage the wild horse population using tools such as sterilization, birth control or humane lethal control.

After receiving the message, study participants responded to a questionnaire asking about their acceptance of five wild horse management options using a 7-point Acceptability scale, ranging from Very Unacceptable to Very Acceptable (i.e. contraception, sterilization, keeping them in holding pens, and two additional methods that involve euthanasia, techniques are not allowable options for the BLM; summarized in Table 2). (Table 2). Participants were then asked questions about their experience with horses and their attitudes and beliefs towards horses using a 7-point Likert scale (Table 2). Demographic information and wildlife value orientations were taken from their original responses to the original study of wildlife values (Manfredo et al. 2018) and therefore not collected in the wild horse survey. We used the Qualtrics platform for survey design and data collection and gave a unique response ID to each participant. We combined the responses from our survey with the responses from the original wildlife values study (Manfredo et al. 2018) using the unique response ID.

Table 2. Variables used in analysis.
Variable
Management options
Round up horses every year and inject them with a contraceptive drug, making them temporarily unable to reproduce.
Round up horses once and sterilize them, making them permanently unable to reproduce.
Round up horses into a holding pen or pasture where they live out the rest of their life, no-matter what it costs.
Round up horses into a holding pen where they are then killed humanely.
Round up horses into a holding pen where they are then killed. Their meat is then sold for human and pet consumption.
Wildlife Value Orientations
Mutualism (mutualist); Five items drawn from the previous survey on wildlife values (Manfredo et al 2018)
Domination (traditionalist); Six items drawn from the previous survey wildlife values (Manfredo et al. 2018)
Attitudes and Beliefs towards and Experience with Horses
I value horses as a symbol of American Freedom
Horses are an important part of my life
Horses facilitated the growth of human civilization
Have you owned a horse?

One-way analysis of variance (ANOVA) was preformed to compare the mean acceptance for each of the five different management options among participants in each of the three different message conditions. A Bonferroni correction was applied to adjust for multiple comparisons. This same approach was used to understand differences in acceptance for the five management options based on message condition and wildlife value orientation.

Linear regression analysis was conducted to examine the extent to which emotional and rational appeals and wildlife value orientations predicted the acceptance of the five wild horse management options in our survey when adjusting for other potential predictors of acceptance. In our regressions, we coded the emotional and rational appeals as 0/1 binary variables. We used

linear regression given Rhemtulla et al., (2012)'s suggestion that ordinal dependent variables with five or more response choices can be treated as continuous variables; however, we also conducted an ordinal logistic regression as a sensitivity analysis (contraception S3-5; sterilization S8-10; live out their lives in holding pens S13-15; killed humanely S18-20; killed humanely and sold for consumption S23-25)**.** The following variables were included as co-variates: sex, income, education, community size, age, horse ownership, value of horses as symbol of American freedom, value of horses as an important part of life, value of horses as important to civilization, traditionalism (domination), and mutualism. Moderation analysis (Baron & Kenny, 1986) was used to explore any significant interaction between message type and wildlife value orientation when predicting acceptability of management options.

RESULTS

Of 2,789 emails sent to past participants of America's Wildlife Values study, 328 completed surveys were received (11.8% response rate). Relatively equal amounts of participants received the control message (n=105), the emotional appeal (n=107), and the rational appeal (n=108). To compare the sample to the general population, demographic information from the 2017 American Community Survey (ACS) was collected for the states where respondents lived (Table 3). Compared to the ACS data, the sample population was wealthier, more educated, and older than the general population (Table 3). Demographics were similar among respondents who received the rational appeal, emotional appeal, and control message suggesting that randomization achieved a relative balance across all groups (Table 3).

Table 3. Description of the sample. Percentages are reported as the percent of the total number of respondents. Data from the 2017 American Community Survey reported is the average across all the states in our sample (AZ, CO, CA, ID, MT, NM, NV, OR, UT, WY).

	Full Sample	Emotional Appeal	Rational Appeal	Control Message	ACS (2017)
Annual Household Income (100,000 and higher)	35.5%	30.8%	32.7%	42.8%	24%
Age Group (55 years and older)	54.4%	58.1%	52.3%	54.4%	27%
Gender (female)	42.2%	50.5%	37%	39.3%	50%
Education (4-year college degree or higher)	68.7%	68.5%	70.1%	67.6%	30%
Community (a farm or rural area)	20.6%	23.8%	15%	23.1%	Not available
Horse Ownership (Yes)	51.8%	50%	45.7%	59.6%	Not available
Mutualist*	34.6%	33.3%	35.2%	35.2%	Not available
Traditionalist*	36.4%	38.1%	30.6%	40.7%	Not available

*These terms are based on measurements of domination and mutualism views of wildlife (Teel & Manfredo 2009; Manfredo et al. 2018).
Domination (traditionalist)- a view of wildlife that prioritizes human well over wildlife and treats wildlife in utilitarian terms
Mutualism (mutualist)- view of wildlife as capable relationships of trust with humans and defined by a desire for companionship with wildlife.

For all three message conditions, the percentage of respondents who indicated the management option was slightly, moderately, or extremely acceptable was highest for contraception and sterilization and lowest for keeping horses in a holding pen for the duration of their lives (Figure 1). Acceptance for the two management options involving euthanasia were similar; among these management options, acceptance was highest for euthanasia and use in consumption among the individuals who received the rational appeal.

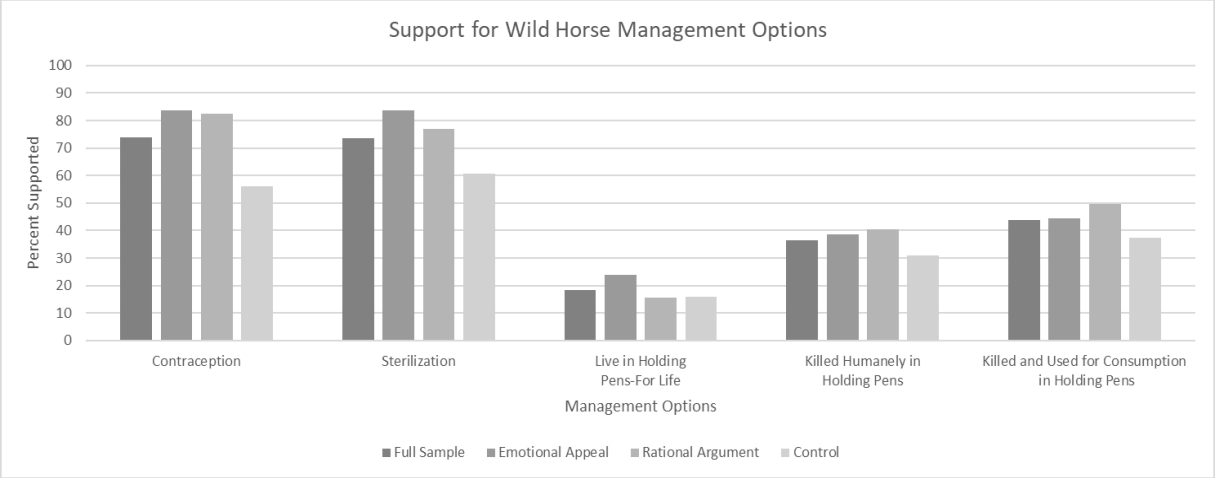

Figure 1. Percent acceptable for each management option. The percentage of respondents who indicated the management option was slightly, moderately, or extremely acceptable for participants in the full sample and all three message conditions (control, rational appeal, and emotional appeal).

The effect of message type and wildlife value orientation on management strategy acceptance

Analysis of variance and regression analyses are reported for each of the five management strategies for wild horses used in this study (contraception, sterilization, living in holding pens, killed humanely in holding pens, and killed and sold for consumption) separately below.

Contraception

A one-way analysis of variance with a Bonferroni multiple comparison test revealed a significant difference in mean acceptance for contraceptive use among respondents who received different messages ($F = 9.75$, $p < .001$) (Table 4). However, there was no significant main effects of wildlife value orientations ($F = 1.91$, $p = 0.168$), and no significant interaction effect between wildlife value orientation and message condition ($F = 0.04$, $p = 0.958$) (Table 4).

Table 4. ANOVA table for contraception

Contraception	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Corrected Model	86.36*	5	17.28	4.38	0.001	0.090
Intercept	6025.96	1	6025.96	1526.42	< 0.001	0.874
Message Condition	77.00	2	38.50	9.75	< 0.001	0.081
Wildlife Value Orientation	7.54	1	7.54	1.91	0.168	0.009
Message Condition* Wildlife Value Orientation	0.34	2	0.17	0.04	0.958	0.000
Error	868.51	220	3.95			
Total	6950	226				
Corrected Total	954.89	225				

*R Squared =0.09 (Adjusted R Squared = 0.07)

Post hoc comparisons using the Bonferroni test for multiple comparisons (Table 5) indicated that the mean level of acceptance for contraception for participants who received the emotional appeal (m = 5.70 out of 7.00) was significantly greater than for those who received the control message (m = 4.41). Mean acceptance of contraception for those who received the rational appeal (m = 5.62) was also significantly greater than for the control message yet not significantly different from the emotional appeal.

Table 5. Post-hoc test for message condition. Bonferroni test for multiple comparisons was performed for the different message conditions.

Contraception	Control	Emotional Appeal	Rational Appeal
Mean	4.41^{a}	5.70^{b}	5.62^{b}

Superscripts indicate statistical significance at $p < 0.05$. Means that share a superscript do not have statistically significant differences.

The regression analysis found that the emotional (β=0.286, $p < 0.001$) and rational (β=0.251, $p < 0.001$) appeals predicted a positive and significant effect on acceptance for contraception compared to the control when adjusting for key co-variates (Table 6). Regression analysis indicated that the emotional appeal did not have a significant effect on acceptance for contraception beyond the rational appeal (Table S-2). The interaction terms and wildlife value orientations were not significant for contraception (Table S-1). This confirmed the findings from the ANOVA analysis when adjusting for key covariates.

Table 6. Regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Contraception	B	β	SE	p
Emotional Appeal (EA)	1.228	0.286	0.271	< 0.001
Rational Appeal (RA)	1.064	0.251	0.272	< 0.001
Sex	-0.078	-0.027	0.175	0.657
Income	0.066	0.041	0.094	0.483
Education	0.242	0.126	0.111	0.031
Community	-0.002	-0.002	0.048	0.967
Age	0.009	0.068	0.007	0.243
Horse Owner	-0.503	-0.125	0.264	0.058
Value horses as a symbol of American freedom	0.039	0.037	0.071	0.582
Value horses as an important part of life	-0.003	-0.003	0.070	0.971
Value horses as important for civilization	0.083	0.056	0.090	0.355
Domination	0.080	0.054	0.110	0.467
Mutualism	0.169	0.124	0.104	0.106
R Square = 0.135 (R Square adjusted = 0.097)				

Sterilization

Analysis of variance revealed a significant difference in mean acceptance for sterilization among respondents who received different messages (F = 5.50, p = 0.005) (Table 7). The analysis of variance also revealed significant differences in mean acceptance between wildlife value orientations (F = 4.47, p = 0.036), but no significant interaction between wildlife value orientation and message condition (F – 0.26, p = 0.769.

Table 7. ANOVA table for sterilization

Sterilization	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Corrected Model	72.65*	5	14.53	3.21	0.008	0.068
Intercept	5970.59	1	5970.59	1318.49	<0.001	0.857
Message Condition	49.78	2	24.89	5.50	0.005	0.048
Wildlife Value Orientation	20.25	1	20.25	4.47	0.036	0.020
Message Condition* Wildlife Value Orientation	2.39	2	1.19	0.26	0.769	0.002
Error	996.24	220	4.53			
Total	7064.00	226				
Corrected Total	1068.89	225				
*R Squared =0.068 (Adjusted R Squared = 0.047)						

No *post-hoc* tests were performed for the wildlife value orientation effect since there were only two groups. Traditionalists showed significantly higher acceptance of sterilization (m = 5.47) than did the mutualists (m = 4.86) (Table 8).

Table 8. ANOVA for wildlife value orientations

Sterilization	Traditionalist	Mutualist
Mean	5.47^{a}	4.86^{b}

Superscripts indicate statistical significance at $p<0.05$. Means that share a superscript do not have statistically significant differences.

Post hoc comparisons using the Bonferroni test for multiple comparisons indicated that the mean level of acceptance for sterilization for respondents who received the emotional appeal (m = 5.75 out of 7.00) was significantly higher than for those who received the control message (m = 4.61) and the rational appeal (m = 5.13) (Table 9). However, the mean score for the rational appeal message condition and the control message were not statistically different from each other.

Table 9. Post-hoc test for message condition. Bonferroni test for multiple comparisons was performed for message conditions.

Sterilization	Control	Emotional Appeal	Rational Appeal
Mean	4.61^{a}	5.75^{b}	5.13^{a}

Superscripts indicate statistical significance at $p<0.05$. Means that share a superscript do not have statistically significant differences.

The regression analysis found that emotional ($\beta=0.281$, $p < 0.001$) and rational ($\beta=0.183$, $p=0.004$) appeals predicted a positive and significant effect on acceptance for sterilization compared to the control when controlling for key co-variates (Table 10). Regression analysis indicated that the emotional appeal did not have a significant effect on acceptance for sterilization beyond the rational appeal (Table S-7). The interaction terms and wildlife value orientations were not significant for sterilization (Table S-6). This confirmed the findings from the ANOVA analysis when adjusting for key covariates.

Table 10. Regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Sterilization	B	β	SE	p
Emotional Appeal (EA)	1.260	0.281	0.281	< 0.001
Rational Appeal (RA)	0.814	0.183	0.282	0.004
Sex	0.117	0.038	0.181	0.519
Income	0.308	0.182	0.098	0.002
Education	0.139	0.069	0.115	0.230
Community	0.065	0.076	0.050	0.192
Age	0.005	0.040	0.008	0.491
Horse Owner	-0.517	-0.123	0.273	0.059
Value horses as a symbol of American freedom	-0.172	-0.154	0.074	0.021
Value horses as an important part of life	-0.022	-0.021	0.072	0.761
Value horses as important for civilization	0.054	0.035	0.093	0.561
Domination	0.231	0.149	0.114	0.045
Mutualism	0.060	0.042	0.108	0.576
R Square = 0.155 (R Square adjusted = 0.117)				

Live out their lives in holding pens

Analysis of variance for horses living out their lives in holding pens (Table 11) revealed significant main effects for message condition ($F = 5.02$, $p = 0.007$) and wildlife value orientation ($F = 14.66$, $p < .001$). It also revealed a statistically significant interaction between wildlife value orientation and message condition ($F = 7.95$, $p < 0.001$) (Table 11).

Table 11. ANOVA table for horses living out their lives in holding pens

Live out their lives in holding pens	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Corrected Model	110.30*	5	22.06	7.81	< 0.001	0.151
Intercept	1401.72	1	1401.72	495.98	0.000	0.693
Message Condition	28.35	2	14.17	5.02	0.007	0.044
Wildlife Value Orientation	41.42	1	41.42	14.66	< 0.001	0.062
Message Condition* Wildlife Value Orientation	44.94	2	22.47	7.95	< 0.001	0.067
Error	621.76	220	2.83			
Total	2095.00	226				
Corrected Total	732.06	225				
*R Squared =0.151 (Adjusted R Squared = 0.131)						

Post hoc comparisons using the Bonferroni test for multiple comparisons (Table 12) indicated that the mean level of acceptance toward allowing horses to live out their lives in holding pens for mutualists who received the emotional appeal (m = 4.00 out of 7.00) was

significantly higher than for all other groups. However, the mean level of acceptance for this management strategy for the other five groups were not statistically different from each other.

Table 12. ANOVA with Bonferroni correction for multiple comparisons

Live out their lives in holding pens	Mutualist Control	Mutualist Emotional Appeal	Mutualist Rational Appeal	Traditionalist Control	Traditionalist Emotional Appeal	Traditionalist Rational Appeal
Mean	2.27[a]	4.00[b]	2.53[a]	1.89[a]	1.88[a]	2.45[a]

Superscripts indicated statistical significance at $p<0.05$. Means that share a superscript do not have statistically significant differences. Groups are participants of a certain wildlife value orientation (traditionalist and mutualists) who got the same message condition (e.g. mutualists who got the control message, etc.).

The regression analysis found that the emotional appeal ($\beta=0.146$, $p=0.021$) predicted a positive and significant effect on acceptance of horses living out their lives in holding pens when compared to the control (Table 13). There was also a positive and significant effect on acceptance of horses living out their lives in holding pens for one interaction term (EA*Domination ($\beta=0.259$, $p=0.011$) (Table S-11).

Table 13. Regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Live in a holding pen for life	B	β	SE	p
Emotional Appeal (EA)	0.513	0.135	0.244	0.036
Rational Appeal (RA)	0.133	0.036	0.244	0.586
Sex	-0.270	-0.104	0.157	0.087
Income	-0.073	-0.051	0.085	0.387
Education	0.169	0.100	0.100	0.092
Community	-0.118	-0.163	0.043	0.007
Age	-0.009	-0.078	0.007	0.191
Horse Owner	0.295	0.083	0.237	0.213
Value horses as a symbol of American freedom	0.065	0.069	0.064	0.311
Value horses as an important part of life	0.018	0.020	0.063	0.780
Value horses as important for civilization	-0.022	-0.017	0.081	0.782
Domination	-0.234	-0.179	0.099	0.019
Mutualism	0.042	0.035	0.093	0.652
R Square = 0.111 (R Square adjusted = 0.072)				

Killed humanely in holding pens

The analysis of variance for horses being euthanized humanely in holding pens revealed significant main effects between wildlife value orientations in level of acceptance for this

strategy (F = 73.34, p = < .001). However, there was no significant main effects among message conditions (F = 1.27, p = 0.284), and no significant interaction effect between wildlife value orientation and message condition (F = 0.07, p = 0.929) (Table 14).

Table 14. ANOVA table for horses being killed humanely in holding pens

Killed humanely in holding pens	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Corrected Model	343.31*	5	68.66	14.93	< 0.001	0.253
Intercept	2456.13	1	2456.13	534.06	< 0.001	0.708
Message Condition	11.65	2	5.83	1.27	0.284	0.011
Wildlife Value Orientation	337.28	1	337.28	73.34	< 0.001	0.250
Message Condition* Wildlife Value Orientation	0.68	2	0.34	0.07	0.929	0.001
Error	1011.77	220	4.60			
Total	3884.00	226				
Corrected Total	1355.08	225				

*R Squared =0.253 (Adjusted R Squared = 0.236)

No *post-hoc* test was conducted because there were only two groups (traditionalists and mutualists). The one-way analysis of variance for horses being killed humanely in holding pens revealed that the mean level of acceptance for this strategy was significantly higher for traditionalists (m = 4.54 out of 7.00) than for mutualists (m = 2.09) (Table 15).

Table 15. ANOVA for wildlife value orientations

Killed humanely in holding pens	Traditionalist	Mutualist
Mean	4.54^{a}	2.09^{b}

Superscripts indicate statistical significance at p<0.05. Means that share a superscript do not have statistically significant differences.

The regression analysis predicted a positive and significant effect on acceptance of horses living in holding pens for participants who had a traditionalist wildlife value orientation (β=0.300, p < 0.001) and a negative and significant effect on acceptance for participants who had mutualist value orientations (β= -0.185, p=0.004) (Table 16). The regression also predicted a positive and significant effect on acceptance for participants who received the rational appeal

(β=0.144, p=0.008). The interaction terms and wildlife value orientations were not significant for sterilization (Table S-16). This confirmed the findings from the ANOVA analysis when adjusting for key covariates.

Table 16 . Regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Killed Humanely in a holding pen	B	β	SE	p
Emotional Appeal (EA)	0.469	0.092	0.270	0.083
Rational Appeal (RA)	0.727	0.144	0.271	0.008
Sex	-0.361	-0.104	0.174	0.039
Income	0.155	0.081	0.094	0.099
Education	0.014	0.006	0.111	0.898
Community	0.140	0.144	0.048	0.004
Age	-0.004	-0.028	0.007	0.569
Horse Owner	-0.032	-0.007	0.262	0.902
Value horses as a symbol of American freedom	-0.329	-0.261	0.071	< 0.001
Value horses as an important part of life	-0.035	-0.030	0.070	0.613
Value horses as important for civilization	-0.024	-0.014	0.090	0.786
Domination	0.529	0.300	0.110	< 0.001
Mutualism	-0.301	-0.185	0.103	0.004
R Square = 0.394 (R Square adjusted = 0.367)				

Killed humanely and sold for consumption

Analysis of variance for the level of acceptance for horses being euthanized humanely and then sold for consumption revealed significant main effects between wildlife value orientations ($F = 109.88$, $p < .001$). However, there was no significant main effects among message conditions, and no significant interaction effect between wildlife value orientation and message condition (Table 17).

Table 17. ANOVA table for horses being killed humanely and sold for consumption

Killed humanely and sold for consumption	Type III Sum of Squares	df	Mean Square	F	p	Partial Eta Squared
Corrected Model	494.59	5	98.92	22.82	< 0.001	0.342
Intercept	3119.80	1	3119.80	719.87	0.000	0.766
Message Condition	23.40	2	11.70	2.70	0.069	0.024
Wildlife Value Orientation	476.20	1	476.20	109.88	< 0.001	0.333
Message Condition* Wildlife Value Orientation	1.06	2	0.53	0.12	0.885	0.001
Error	953.45	220	4.33			
Total	4660.00	226				
Corrected Total	1448.04	225				

*R Squared =0.09 (Adjusted R Squared = 0.07)

No *post-hoc* tests were conducted because there were only two groups (traditionalists and mutualists). The one-way analysis of variance for horses being killed humanely in holding pens revealed that the acceptance level for this strategy was significantly higher for traditionalists (m = 5.19 out of 7.00) than for mutualists (m = 2.27) (Table 18).

Table 18. ANOVA for wildlife value orientations

Killed humanely and sold for consumption	Traditionalist	Mutualist
Mean	5.19^{a}	2.27^{b}

Superscripts indicate statistical significance at p<0.05. Means that share a superscript do not have statistically significant differences.

Regression analysis predicted a negative and significant effect on acceptance of horses being euthanized and sold for consumption for participants who had a mutualist wildlife value orientation (β= -0.245, p < 0.001) (Table 19). The regression also predicted a positive and significant effect on acceptance of horses being euthanized and sold for consumption for participants who had a traditionalist wildlife value orientation (β=0.300, p < 0.001). There is also a positive and significant effect on acceptance for participants who received the emotional (β=0.144, p=0.005) and rational (β=0.160, p=0.002) appeals (Table 19). Regression analysis indicated that the emotional appeal did not have a significant effect on acceptance for horses

being killed humanely and sold for consumption beyond the rational appeal (Table S-22). The interaction terms and wildlife value orientations were not significant for sterilization (Table S-21). This confirmed the findings from the ANOVA analysis when adjusting for key covariates.

Table 19 . Regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Killed humanely and sold for consumption	B	β	SE	p
Emotional Appeal (EA)	0.761	0.144	0.271	0.005
Rational Appeal (RA)	0.840	0.160	0.271	0.002
Sex	-0.523	-0.145	0.174	0.003
Income	0.167	0.084	0.094	0.077
Education	0.019	0.008	0.111	0.867
Community	0.087	0.086	0.048	0.072
Age	-0.004	-0.024	0.007	0.613
Horse Owner	0.148	0.030	0.263	0.573
Value horses as a symbol of American freedom	-0.280	-0.213	0.071	< 0.001
Value horses as an important part of life	-0.052	-0.043	0.070	0.452
Value horses as important for civilization	0.075	0.041	0.090	0.402
Domination	0.548	0.300	0.110	< 0.001
Mutualism	-0.414	-0.245	0.104	< 0.001
R Square = 0.437 (R Square adjusted = 0.413)				

Wildlife value orientations and acceptance of management strategies

After the analysis for each management strategy was conducted, we were interested in the rate of acceptance for each strategy by wildlife life value orientation was examined (Figure 2). The percent acceptance for contraception and sterilization was higher for participants who received the emotional and rational appeals regardless of their wildlife value orientation. Furthermore, the percent acceptance for the two lethal control strategies were highest for participants who had traditionalist wildlife value orientations. Also shown in figure two is the high rates of acceptance for horses living out their lives in holding pens for mutualists who received the emotional appeal.

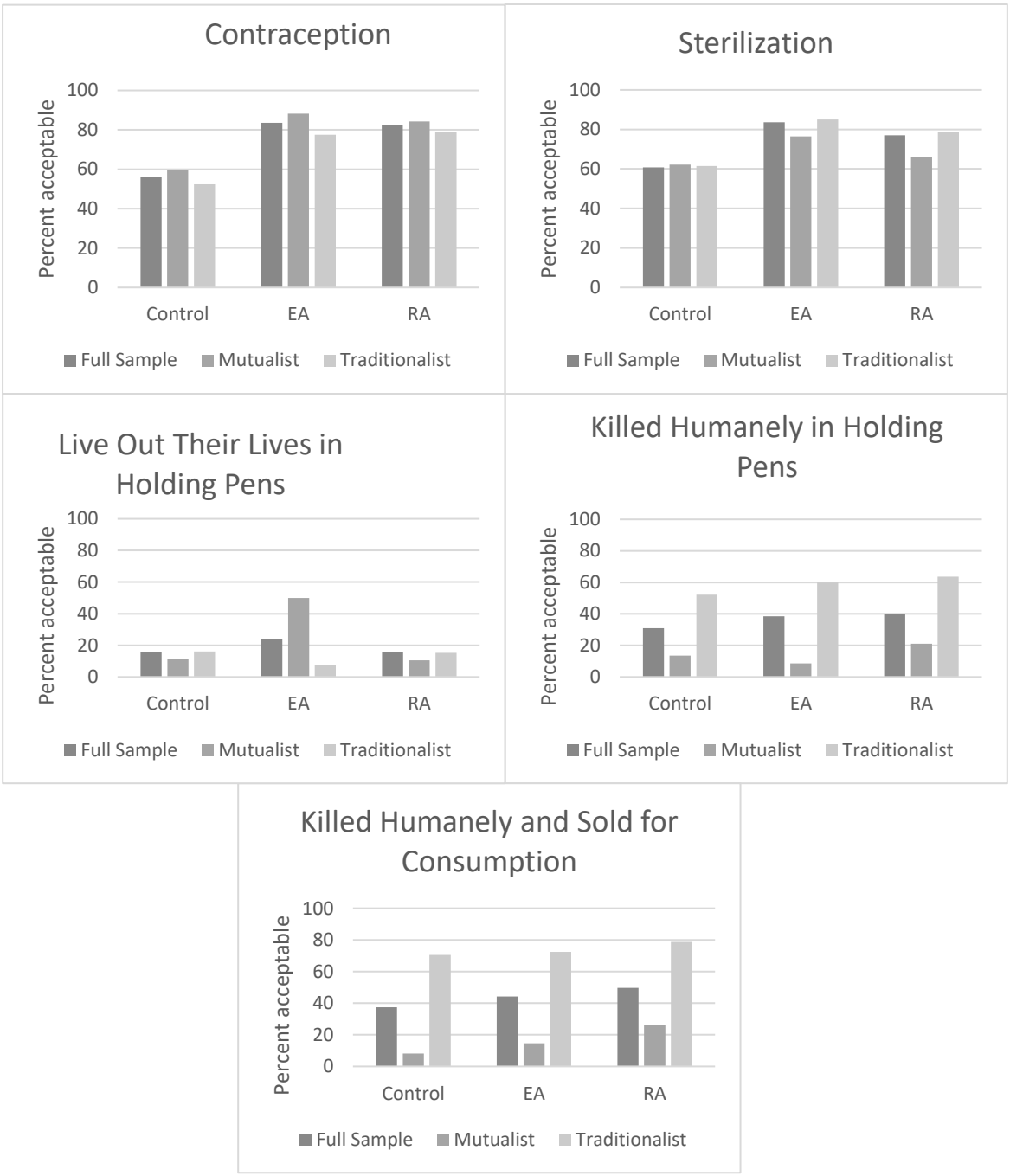

Figure 2. Percent acceptable for each management option by the full sample and traditionalist and mutualist value orientations. Percent acceptable given for all three message conditions.

DISCUSSION

Few animals in the western United States evoke as much emotion and public concern as wild horses (Scasta, 2019). People's emotional responses to horses as well as the increasing need for management of wild populations have resulted in controversy about this issue throughout the West (Michaels, 2018; Scasta et al., 2018; Scasta, 2019). Understanding public attitudes is crucial for increasing public support for management techniques (Echeverri, Chan, & Zhao, 2017; Manfredo, 2008; Teel et al., 2005), and many studies show that messaging can have an effect on people's attitudes toward a given issue such as wildlife management (Echeverri et al., 2017; Kidd et al., 2019; Miller et al., 2018; Wolsko, Ariceaga, & Seiden, 2016). The controversy surrounding wild horses and the emergence of messaging studies led to a messaging experiment about wild horse management. The current study finds that emotional and rational messages about the negative impacts of the growing wild horse populations and the need for management increase the acceptance of certain wild horse management techniques, when compared to a control message.

In our survey-based experiment, the rational appeal (which included information about the negative impacts of wild horse overpopulation and the need for management) significantly increased acceptance of four out of five management options, and the emotional appeal (which added a picture of emaciated wild horses to the rational appeal) significantly increased acceptance of all 5 management options when compared to the control message (which included basic information about wild horse populations and their management). There was no significant difference between the emotional and rational appeals when compared to each other in the regression analyses. Although in the ordinal regression for sterilization there was a significant

difference between the emotional and rational appeals. This suggests that the emotional appeal had more of an effect on participants acceptance of sterilization than the rational appeal. The two distinct types of appeals may have had similar and positive effects on public acceptance because they filled a key knowledge gap among the public. Michaels (2018) has suggested that the largest threat to wild horse populations and rangeland is the public's misconceptions about wild horse populations and the ecosystem damage caused by overpopulation. He explains this threat as the well-meaning public's rally behind wild horses limiting the acceptable management strategies and creating challenges for managers (Michaels, 2018). Previous research suggests that people have a deep concern for horse well-being but many people are unaware of actual management techniques used by the BLM (Michaels, 2018; Scasta et al., 2018; Scasta, 2019). Our findings suggest that filling these knowledge gaps through rational and emotional appeals that highlight the negative impacts of wild horse overpopulation and the need for further management may help build support for novel management techniques, such as contraception and sterilization.

Our findings are consistent with past studies, which have suggested that rational and emotional appeals have the ability to influence attitudes (Morrison, Greig, Waller, McCulloch, & Read, 2017; Yoon, Jeong, Chon, & Yoon, 2019; Zinn & Manfredo, 2000). Zinn & Manfredo (2000) found that both rational and emotional appeals were equally persuasive, while Morrison et al. (2017) found that rational appeals were more influential to respondents than emotional appeals. We found that both rational appeals and an emotional component within the appeal significantly influenced acceptance of wild horse management techniques when compared to the control message, but rational and emotional appeals were not significantly different from one another in their effectiveness at increasing acceptability for most management techniques in the study. In some situations, and for some people (mutualists) adding an emotional appeal to a

rational argument may enhance acceptance of management techniques. These results suggest a need for future studies examining whether, and the conditions under which, emotional or rational appeals may be most effective.

Our findings suggest that among our sample, there is acceptance for novel management techniques on public land. People in our sample were most accepting of the use of contraception and sterilization and least accepting of removing these animals and keeping them in holding pens. Michaels (2018) argues that the public is opposed to gathering, sterilizing, managing, or euthanizing these animals because of human's deep connection to horses. Our study suggests that among our sample, this may not be the case. Our study therefore provides promising preliminary evidence suggesting that certain management techniques (i.e. sterilization, contraception) may not be met with level of public opposition that others have assumed (i.e. Michaels, 2018).

Previous research shows that wildlife value orientations are important predictors of public support for various wildlife management strategies (Bright et al., 2000; Miller et al., 2018; Teel & Manfredo, 2010). We found a statistically significant relationship between wildlife value orientation and several of the management options. Traditionalist value orientation was a significant positive predictor and mutualism value orientation was a significant negative predictor of acceptance of the management techniques that included euthanasia. This aligns with previous studies suggesting differences in acceptance levels of management options based on wildlife value orientation (Bright et al., 2000; Manfredo, Teel, & Bright, 2003; Miller et al., 2018; Teel & Manfredo, 2010). Wildlife values have been shown to influence attitudes toward wildlife related management actions, and actions such as killing excess animals are associated with the traditionalist value orientation (Bright et al., 2000; Manfredo et al., 2003; Miller et al., 2018). Our findings provide further support to this link between traditionalist value orientation

and acceptance lethal control measures (or mutualist value orientation and lack of support for killing of animals) as a management option. In the 19 western U.S., Manfredo and colleagues (2018) found on average traditionalism decreased (5.7%) and mutualism increased (4.7%) between 2004 and 2018 and they attribute this shift to modernization. Our findings suggest that if this trend continues and more people become mutualist, acceptance of lethal management options will decline. Therefore, nonlethal management strategies such as contraception and sterilization will be critical for addressing wildlife population concerns in the future.

There are a few key limitations to our study. First, the response rate for our survey was 11 percent and the sample size was relatively small for generalizing. Second, the demographics of our sample when compared to state averages in the ten states sampled; were primarily older (55 years and older), white, rural residents who were highly educated and wealthier (Table 1). Thus, our findings may not be generalizable to the broader population. Furthermore, we only surveyed people that currently reside in the ten states that have wild horse populations in the western United states. Public responses to wild horse management may vary in other states. Future studies are therefore needed to build on ours to examine public attitudes towards wild horse management and the effectiveness of messaging with a larger, representative sample.

Various studies have been conducted to research the effectiveness of contraception (Kirkpatrick et al., 2011; National Research Council, 2013; Norris, 2018) and sterilization (Eagle, Asa, Garrott, Plotka, & Donald, 1993; R. A. Garrott & Siniff, 1992) in wild horse populations, and our results suggest that there is support for the use of these options among our sample if they are available. Management of wild horses is a contentious issue with many layers of social, ecological and legal considerations (Michaels, 2018; Perryman et al., 2018). It has often been assumed that the public has deeply entrenched positions on horse management;

however, our study suggests that messaging could help increase public acceptance of certain management options. Further research could continue to explore the influence of messaging on attitudes and acceptance levels of management options and desired conservation outcomes.

CONCLUSION

We built on previous research suggesting the importance of message framing and wildlife value orientations in understanding people's attitudes towards wildlife management (Echeverri et al., 2017; Kidd et al., 2019; Pimm, 2000; Wolsko et al., 2016; Zinn & Manfredo, 2000; Miller et al., 2018; Teel & Manfredo, 2010). We found that emotional components and rational messages describing the need for management as well as value orientations influence acceptance of wild horse management techniques. We also found that the main wild horse management strategy being used in the American West was the least acceptable option among our sample. Our research provides promising preliminary evidence that carefully crafted communication campaigns that apply emotional and rational appeals could be an effective way to build public support for new management strategies.

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APPENDIX

Contraception

Table S-1. Linear regression analysis with interaction terms for contraception. analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Contraception with Interaction Terms	B	β	SE	p
Emotional Appeal (EA)	1.213	0.283	0.276	< 0.001
Rational Appeal (RA)	1.044	0.246	0.277	< 0.001
Sex	-0.081	-0.028	0.176	0.646
Income	0.070	0.043	0.095	0.463
Education	0.244	0.127	0.114	0.032
Community	-0.004	-0.005	0.049	0.928
Age	0.009	0.069	0.007	0.240
Horse Owner	-0.504	-0.125	0.266	0.059
Value horses as a symbol of American freedom	0.035	0.033	0.072	0.626
Value horses as an important part of life	-0.003	-0.003	0.070	0.971
Value horses as important for civilization	0.088	0.059	0.092	0.340
Domination	0.138	0.093	0.181	0.447
Mutualism	0.247	0.181	0.182	0.175
EA * Mutual	0.151	0.065	0.250	0.548
EA * Domination	0.130	0.051	0.266	0.625
RA * Mutual	0.082	0.033	0.240	0.733
RA * Domination	0.044	0.016	0.255	0.864
$R^2 = 0.137$ (R^2 adjusted = 0.086)				

Table S-2. Linear regression analysis (with Rational Appeal as Constant) both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Contraception	B	β	SE	p
Control Message	-1.064	-0.250	0.272	< 0.001
Emotional Appeal (EA)	0.164	0.038	0.271	0.547
Sex	-0.078	-0.027	0.175	0.656
Income	0.066	0.041	0.094	0.484
Education	0.242	0.126	0.111	0.031
Community	-0.002	-0.002	0.048	0.966
Age	0.009	0.069	0.007	0.243
Horse Owner	-0.502	-0.125	0.264	0.058
Value horses as a symbol of American freedom	0.039	0.037	0.071	0.583
Value horses as an important part of life	-0.003	-0.003	0.070	0.970
Value horses as important for civilization	0.084	0.057	0.090	0.354
Domination	0.080	0.054	0.110	0.467
Mutualism	0.169	0.124	0.104	0.105
R Square = 0.135 (R Square adjusted = 0.097)				

Table S-3. Ordinal regression analysis. Standard error and p-value is provided for the management strategy.

Contraception	Estimate	SE	p
Emotional Appeal (EA)	1.133	0.262	< 0.001
Rational Appeal (RA)	1.089	0.265	< 0.001
Sex	0.055	0.163	0.734
Income	0.010	0.091	0.909
Education	0.150	0.107	0.162
Community	0.008	0.047	0.868
Age	0.011	0.007	0.118
Horse Owner	-0.349	0.253	0.169
Value horses as a symbol of American freedom	0.016	0.068	0.807
Value horses as an important part of life	0.001	0.067	0.988
Value horses as important for civilization	0.074	0.085	0.384
Domination	0.054	0.105	0.610
Mutualism	0.106	0.100	0.290
Cox and Snell Pseudo R Square = 0.116			

Table S-4. Ordinal regression analysis (Rational Appeal as constant). Standard error and p-value is provided for the management strategy.

Contraception	Estimate	SE	p
Control Message	-1.089	0.265	< 0.001
Emotional Appeal (EA)	0.045	0.264	0.866
Sex	0.055	0.163	0.734
Income	0.010	0.091	0.909
Education	0.150	0.107	0.162
Community	0.008	0.047	0.868
Age	0.011	0.007	0.118
Horse Owner	-0.349	0.253	0.169
Value horses as a symbol of American freedom	0.016	0.068	0.807
Value horses as an important part of life	0.001	0.067	0.988
Value horses as important for civilization	0.074	0.085	0.384
Domination	0.054	0.105	0.610
Mutualism	0.106	0.100	0.290
Cox and Snell Pseudo R Square = 0.116			

Table S-5. Ordinal regression analysis (with interaction terms). Standard error and p-value is provided for the management strategy.

Contraception	Estimate	SE	p
Emotional Appeal (EA)	1.169	0.267	< 0.001
Rational Appeal (RA)	1.083	0.269	< 0.001
Sex	0.057	0.164	0.726
Income	0.025	0.091	0.787
Education	0.149	0.109	0.170
Community	0.010	0.048	0.828
Age	0.011	0.007	0.109
Horse Owner	-0.361	0.255	0.158
Value horses as a symbol of American freedom	0.013	0.068	0.853
Value horses as an important part of life	-0.002	0.067	0.981
Value horses as important for civilization	0.094	0.087	0.281
Domination	0.153	0.165	0.354
Mutualism	0.196	0.167	0.240
EA * Mutual	0.165	0.233	0.478
EA * Domination	0.344	0.253	0.174
RA * Mutual	0.140	0.229	0.541
RA * Domination	0.008	0.242	0.973
Cox and Snell Pseudo R Square = 0.125			

Sterilization

Table S-6. Linear regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Sterilization Interaction	B	β	SE	p
Emotional Appeal (EA)	1.286	0.286	0.284	< 0.001
Rational Appeal (RA)	0.863	0.194	0.285	0.003
Sex	0.115	0.037	0.181	0.528
Income	0.301	0.178	0.098	0.002
Education	0.160	0.080	0.117	0.173
Community	0.071	0.083	0.051	0.160
Age	0.005	0.035	0.008	0.549
Horse Owner	-0.525	-0.125	0.274	0.056
Value horses as a symbol of American freedom	-0.164	-0.147	0.074	0.028
Value horses as an important part of life	-0.017	-0.016	0.073	0.814
Value horses as important for civilization	0.041	0.027	0.095	0.662
Domination	-0.033	-0.021	0.186	0.858
Mutualism	-0.119	-0.083	0.187	0.525
EA * Mutual	-0.221	-0.091	0.258	0.393
EA * Domination	-0.334	-0.124	0.274	0.224
RA * Mutual	-0.285	-0.109	0.247	0.250
RA * Domination	-0.486	-0.165	0.263	0.066
R Square = 0.165 (R Square adjusted = 0.116)				

Table S-7. Linear regression analysis (with Rational Appeal as constant) both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Sterilization	B	β	SE	p
Control Message	-0.811	-0.182	0.282	0.004
Emotional Appeal (EA)	0.448	0.100	0.281	0.112
Sex	0.116	0.038	0.181	0.521
Income	0.308	0.182	0.098	0.002
Education	0.139	0.069	0.115	0.230
Community	0.065	0.076	0.050	0.193
Age	0.005	0.040	0.008	0.491
Horse Owner	-0.517	-0.123	0.273	0.059
Value horses as a symbol of American freedom	-0.172	-0.155	0.074	0.021
Value horses as an important part of life	-0.022	-0.021	0.072	0.761
Value horses as important for civilization	0.055	0.035	0.093	0.558
Domination	0.231	0.149	0.114	0.044
Mutualism	0.061	0.042	0.108	0.575
R Square = 0.154 (R Square adjusted = 0.117)				

Table S-8. Ordinal regression analysis. Standard error and p-value is provided for the management strategy.

Sterilization	Estimate	SE	p
Emotional Appeal (EA)	1.253	0.272	< 0.001
Rational Appeal (RA)	0.719	0.264	0.006
Sex	0.089	0.164	0.589
Income	0.264	0.096	0.006
Education	0.075	0.110	0.496
Community	0.087	0.048	0.072
Age	0.007	0.007	0.359
Horse Owner	-0.521	0.260	0.045
Value horses as a symbol of American freedom	-0.180	0.072	0.012
Value horses as an important part of life	-0.018	0.069	0.791
Value horses as important for civilization	0.070	0.089	0.432
Domination	0.180	0.107	0.094
Mutualism	0.032	0.102	0.752
Cox and Snell Pseudo R Square = 0.151			

Table S-9. Ordinal regression analysis (Rational Appeal as constant). Standard error and p-value is provided for the management strategy.

Sterilization	Estimate	SE	p
Control Message	-0.719	0.264	0.006
Emotional Appeal (EA)	0.534	0.272	0.050

Sex	0.089	0.164	0.589
Income	0.264	0.096	0.006
Education	0.075	0.110	0.496
Community	0.087	0.048	0.072
Age	0.007	0.007	0.359
Horse Owner	-0.521	0.260	0.045
Value horses as a symbol of American freedom	-0.180	0.072	0.012
Value horses as an important part of life	-0.018	0.069	0.791
Value horses as important for civilization	0.070	0.089	0.432
Domination	0.180	0.107	0.094
Mutualism	0.032	0.102	0.752
Cox and Snell Pseudo R Square = 0.151			

Table S-10. Ordinal regression analysis (with interaction terms). Standard error and p-value is provided for the management strategy.

Sterilization	Estimate	SE	p
Emotional Appeal (EA)	1.278	0.274	< 0.001
Rational Appeal (RA)	0.754	0.268	0.005
Sex	0.094	0.165	0.567
Income	0.257	0.096	0.008
Education	0.094	0.112	0.399
Community	0.092	0.049	0.060
Age	0.006	0.007	0.388
Horse Owner	-0.527	0.262	0.044
Value horses as a symbol of American freedom	-0.179	0.072	0.013
Value horses as an important part of life	-0.015	0.069	0.831
Value horses as important for civilization	0.070	0.090	0.433
Domination	-0.019	0.166	0.911
Mutualism	-0.113	0.169	0.502
EA * Mutual	-0.148	0.241	0.538
EA * Domination	-0.174	0.255	0.494
RA * Mutual	-0.243	0.233	0.296
RA * Domination	-0.439	0.244	0.072
Cox and Snell Pseudo R Square = 0.159			

Live out their lives in holding pens

Table S-11. Linear regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Live in holding pen for life Interaction	B	β	SE	p
Emotional Appeal (EA)	0.555	0.146	0.239	0.021
Rational Appeal (RA)	0.132	0.035	0.240	0.583
Sex	-0.266	-0.103	0.153	0.082
Income	-0.057	-0.040	0.083	0.491
Education	0.122	0.072	0.099	0.216
Community	-0.099	-0.136	0.043	0.021
Age	-0.008	-0.073	0.006	0.207
Horse Owner	0.239	0.067	0.231	0.301
Value horses as a symbol of American freedom	0.057	0.060	0.063	0.366
Value horses as an important part of life	0.011	0.012	0.061	0.859
Value horses as important for civilization	0.030	0.023	0.080	0.707
Domination	0.013	0.010	0.157	0.933

Mutualism	0.143	0.119	0.158	0.363
EA * Mutual	-0.013	-0.006	0.217	0.952
EA * Domination	0.589	0.259	0.231	0.011
RA * Mutual	0.358	0.162	0.208	0.086
RA * Domination	0.183	0.073	0.222	0.410
R Square = 0.171 (R Square adjusted = 0.123)				

Table S-12. Linear regression analysis (with Rational Appeal as constant) both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Live in a holding pen for life	B	β	SE	p
Control Message	-0.134	-0.035	0.244	0.585
Emotional Appeal (EA)	0.380	0.100	0.243	0.119
Sex	-0.270	-0.104	0.157	0.087
Income	-0.073	-0.051	0.085	0.387
Education	0.169	0.100	0.100	0.092
Community	-0.118	-0.163	0.043	0.007
Age	-0.009	-0.078	0.007	0.191
Horse Owner	0.295	0.083	0.237	0.213
Value horses as a symbol of American freedom	0.065	0.069	0.064	0.311
Value horses as an important part of life	0.018	0.020	0.063	0.780
Value horses as important for civilization	-0.022	-0.017	0.081	0.782
Domination	-0.234	-0.179	0.099	0.019
Mutualism	0.042	0.035	0.093	0.652
R Square = 0.111 (R Square adjusted = 0.072)				

Table S-13. Ordinal regression analysis. Standard error and p-value is provided for the management strategy.

Live in a holding pen for life	Estimate	SE	p
Emotional Appeal (EA)	0.645	0.268	0.016
Rational Appeal (RA)	0.317	0.270	0.241
Sex	-0.385	0.219	0.079
Income	-0.103	0.094	0.273
Education	0.396	0.114	0.001
Community	-0.088	0.048	0.065
Age	-0.018	0.007	0.015
Horse Owner	0.254	0.258	0.325
Value horses as a symbol of American freedom	0.139	0.072	0.054
Value horses as an important part of life	-0.022	0.070	0.754
Value horses as important for civilization	-0.032	0.089	0.722
Domination	-0.230	0.109	0.034
Mutualism	0.074	0.104	0.475
Cox and Snell Pseudo R Square = 0.142			

Table S-14. Ordinal regression analysis (Rational Appeal as constant). Standard error and p-value is provided for the management strategy.

Live in a holding pen for life	Estimate	SE	p
Control Message	-0.317	0.270	0.241
Emotional Appeal (EA)	0.328	0.262	0.210
Sex	-0.385	0.219	0.079
Income	-0.103	0.094	0.273
Education	0.396	0.114	0.001
Community	-0.088	0.048	0.065
Age	-0.018	0.007	0.015
Horse Owner	0.254	0.258	0.325
Value horses as a symbol of American freedom	0.139	0.072	0.054
Value horses as an important part of life	-0.022	0.070	0.754
Value horses as important for civilization	-0.032	0.089	0.722
Domination	-0.230	0.109	0.034
Mutualism	0.074	0.104	0.475
Cox and Snell Pseudo R Square = 0.142			

Table S-15. Ordinal regression analysis (with interaction terms). Standard error and p-value is provided for the management strategy.

Live in a holding pen for life	Estimate	SE	p
Emotional Appeal (EA)	0.689	0.272	0.011
Rational Appeal (RA)	0.309	0.271	0.254
Sex	-0.379	0.217	0.081
Income	-0.075	0.095	0.426
Education	0.355	0.116	0.002
Community	-0.063	0.049	0.192
Age	-0.018	0.007	0.011
Horse Owner	0.187	0.258	0.470
Value horses as a symbol of American freedom	0.137	0.073	0.059
Value horses as an important part of life	-0.017	0.070	0.805
Value horses as important for civilization	0.007	0.090	0.936
Domination	0.038	0.177	0.832
Mutualism	0.225	0.182	0.218
EA * Mutual	0.042	0.250	0.868
EA * Domination	0.656	0.259	0.011
RA * Mutual	0.457	0.240	0.057
RA * Domination	0.250	0.250	0.318
Cox and Snell Pseudo R Square = 0.190			

Killed humanely in holding pens

Table S-16. Linear regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Killed Humanely in holding pen Interaction	B	β	SE	p
Emotional Appeal (EA)	0.491	0.096	0.274	0.074
Rational Appeal (RA)	0.768	0.152	0.275	0.006
Sex	-0.362	-0.104	0.175	0.039
Income	0.149	0.078	0.094	0.116
Education	0.035	0.015	0.113	0.756

Community	0.144	0.148	0.049	0.003
Age	-0.005	-0.032	0.007	0.519
Horse Owner	-0.038	-0.008	0.264	0.886
Value horses as a symbol of American freedom	-0.323	-0.255	0.072	0.000
Value horses as an important part of life	-0.031	-0.026	0.070	0.656
Value horses as important for civilization	-0.038	-0.022	0.091	0.676
Domination	0.312	0.177	0.179	0.083
Mutualism	-0.455	-0.281	0.180	0.012
EA * Mutual	-0.164	-0.060	0.248	0.511
EA * Domination	-0.267	-0.088	0.264	0.312
RA * Mutual	-0.272	-0.091	0.238	0.253
RA * Domination	-0.399	-0.119	0.253	0.117
R Square = 0.400 (R Square adjusted = 0.365)				

Table S-17. Linear regression analysis (with Rational Appeal as constant) both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Killed Humanely in a holding pen	B	β	SE	p
Control Message	-0.726	-0.143	0.271	0.008
Emotional Appeal (EA)	-0.257	-0.050	0.270	0.342
Sex	-0.361	-0.104	0.174	0.039
Income	0.155	0.081	0.094	0.099
Education	0.014	0.006	0.111	0.897
Community	0.140	0.144	0.048	0.004
Age	-0.004	-0.028	0.007	0.570
Horse Owner	-0.032	-0.007	0.262	0.902
Value horses as a symbol of American freedom	-0.330	-0.261	0.071	< 0.001
Value horses as an important part of life	-0.035	-0.030	0.070	0.613
Value horses as important for civilization	-0.024	-0.014	0.090	0.787
Domination	0.529	0.300	0.110	< 0.001
Mutualism	-0.301	-0.185	0.103	0.004
R Square = 0.394 (R Square adjusted = 0.367)				

Table S-18. Ordinal regression analysis. Standard error and p-value is provided for the management strategy.

Killed humanely in holding pens	Estimate	SE	p
Emotional Appeal (EA)	0.488	0.285	0.087
Rational Appeal (RA)	0.918	0.287	0.001
Sex	-0.635	0.263	0.016
Income	0.151	0.099	0.126
Education	0.011	0.115	0.926
Community	0.161	0.051	0.002
Age	-0.004	0.008	0.573
Horse Owner	-0.055	0.270	0.838
Value horses as a symbol of American freedom	-0.358	0.074	< 0.001
Value horses as an important part of life	-0.033	0.073	0.646

Value horses as important for civilization	-0.018	0.089	0.838
Domination	0.569	0.126	< 0.001
Mutualism	-0.276	0.105	0.008
Cox and Snell Pseudo R Square = 0.409			

Table S-19. Ordinal regression analysis (Rational Appeal as constant). Standard error and p-value is provided for the management strategy.

Killed humanely in holding pens	Estimate	SE	p
Control Message	-0.918	0.287	0.001
Emotional Appeal (EA)	-0.430	0.277	0.120
Sex	-0.635	0.263	0.016
Income	0.151	0.099	0.126
Education	0.011	0.115	0.926
Community	0.161	0.051	0.002
Age	-0.004	0.008	0.573
Horse Owner	-0.055	0.270	0.838
Value horses as a symbol of American freedom	-0.358	0.074	< 0.001
Value horses as an important part of life	-0.033	0.073	0.646
Value horses as important for civilization	-0.018	0.089	0.838
Domination	0.569	0.126	< 0.001
Mutualism	-0.276	0.105	0.008
Cox and Snell Pseudo R Square = 0.409			

Table S-20. Ordinal regression analysis (with interaction terms). Standard error and p-value is provided for the management strategy.

Killed humanely in holding pens	Estimate	SE	p
Emotional Appeal (EA)	0.516	0.310	0.096
Rational Appeal (RA)	0.965	0.299	0.001
Sex	-0.652	0.264	0.014
Income	0.139	0.099	0.159
Education	0.018	0.117	0.879
Community	0.164	0.051	0.001
Age	-0.005	0.008	0.556
Horse Owner	-0.055	0.271	0.840
Value horses as a symbol of American freedom	-0.354	0.075	< 0.001
Value horses as an important part of life	-0.031	0.073	0.673
Value horses as important for civilization	-0.029	0.091	0.747
Domination	0.390	0.202	0.053
Mutualism	-0.466	0.188	0.013
EA * Mutual	-0.262	0.254	0.301
EA * Domination	-0.313	0.300	0.296
RA * Mutual	-0.277	0.247	0.261
RA * Domination	-0.231	0.273	0.398
Cox and Snell Pseudo R Square = 0.413			

Killed humanely and sold for consumption

Table S-21. Linear regression analysis both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Killed humanely and sold for consumption Interaction	B	β	SE	p
Emotional Appeal (EA)	0.795	0.150	0.274	0.004
Rational Appeal (RA)	0.895	0.171	0.275	0.001
Sex	-0.519	-0.144	0.175	0.003
Income	0.158	0.080	0.094	0.095
Education	0.024	0.010	0.113	0.832
Community	0.095	0.093	0.049	0.053
Age	-0.004	-0.027	0.007	0.568
Horse Owner	0.144	0.029	0.264	0.586
Value horses as a symbol of American freedom	-0.271	-0.206	0.072	< 0.001
Value horses as an important part of life	-0.050	-0.041	0.070	0.475
Value horses as important for civilization	0.065	0.036	0.091	0.474
Domination	0.334	0.183	0.180	0.064
Mutualism	-0.613	-0.364	0.180	0.001
EA * Mutual	-0.337	-0.118	0.249	0.176
EA * Domination	-0.346	-0.109	0.264	0.191
RA * Mutual	-0.238	-0.077	0.238	0.317
RA * Domination	-0.316	-0.091	0.254	0.214
R Square = 0.442 (R Square adjusted = 0.410)				

Table S-22. Linear regression analysis (with Rational Appeal as constant) both standardized and unstandardized beta are reported. Standard error and p-value is provided for the management strategy.

Killed humanely and sold for consumption	B	β	SE	p
Control Message	-0.840	-0.160	0.271	0.002
Emotional Appeal (EA)	-0.079	-0.015	0.270	0.770
Sex	-0.523	-0.145	0.174	0.003
Income	0.167	0.084	0.094	0.078
Education	0.019	0.008	0.111	0.866
Community	0.087	0.086	0.048	0.072
Age	-0.004	-0.024	0.007	0.613
Horse Owner	0.148	0.030	0.263	0.573
Value horses as a symbol of American freedom	-0.280	-0.213	0.071	< 0.001
Value horses as an important part of life	-0.052	-0.043	0.070	0.452
Value horses as important for civilization	0.076	0.041	0.090	0.401
Domination	0.548	0.300	0.110	< 0.001
Mutualism	-0.414	-0.245	0.104	< 0.001
R Square = 0.437 (R Square adjusted = 0.413)				

Table S-23. Ordinal regression analysis. Standard error and p-value is provided for the management strategy.

Killed humanely and sold for consumption	Estimate	SE	p
Emotional Appeal (EA)	1.059	0.293	< 0.001

Rational Appeal (RA)	1.071	0.293	< 0.001
Sex	-1.113	0.268	< 0.001
Income	0.185	0.101	0.066
Education	0.072	0.117	0.536
Community	0.105	0.051	0.038
Age	-0.011	0.008	0.164
Horse Owner	0.132	0.274	0.631
Value horses as a symbol of American freedom	-0.340	0.076	< 0.001
Value horses as an important part of life	0.017	0.074	0.816
Value horses as important for civilization	0.051	0.092	0.581
Domination	0.558	0.126	< 0.001
Mutualism	-0.377	0.107	< 0.001
Cox and Snell Pseudo R Square = 0.451			

Table S-24. Ordinal regression analysis (Rational Appeal as constant). Standard error and p-value is provided for the management strategy.

Killed humanely and sold for consumption	Estimate	SE	p
Control Message	-1.071	0.293	< 0.001
Emotional Appeal (EA)	-0.012	0.277	0.965
Sex	-1.113	0.268	< 0.001
Income	0.185	0.101	0.066
Education	0.072	0.117	0.536
Community	0.105	0.051	0.038
Age	-0.011	0.008	0.164
Horse Owner	0.132	0.274	0.631
Value horses as a symbol of American freedom	-0.340	0.076	< 0.001
Value horses as an important part of life	0.017	0.074	0.816
Value horses as important for civilization	0.051	0.092	0.581
Domination	0.558	0.126	< 0.001
Mutualism	-0.377	0.107	< 0.001
Cox and Snell Pseudo R Square = 0.451			

Table S-25. Ordinal regression analysis (with interaction terms). Standard error and p-value is provided for the management strategy.

Killed humanely and sold for consumption	Estimate	SE	p
Emotional Appeal (EA)	1.158	0.319	< 0.001
Rational Appeal (RA)	1.190	0.311	< 0.001
Sex	-1.140	0.270	< 0.001
Income	0.181	0.101	0.074
Education	0.053	0.119	0.656
Community	0.111	0.051	0.031
Age	-0.011	0.008	0.159
Horse Owner	0.138	0.276	0.618
Value horses as a symbol of American freedom	-0.335	0.077	< 0.001
Value horses as an important part of life	0.020	0.075	0.793
Value horses as important for civilization	0.048	0.093	0.611
Domination	0.371	0.210	0.077
Mutualism	-0.646	0.199	0.001
EA * Mutual	-0.493	0.262	0.059
EA * Domination	-0.420	0.302	0.165
RA * Mutual	-0.266	0.257	0.300
RA * Domination	-0.142	0.277	0.610

Cox and Snell Pseudo R Square = 0.458