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Prediction of Protocol Approval in a Mock Institutional Animal Care and Use Committee: Evaluation of Type of Research Protocol, Species, and Evaluator Characteristics

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Abstract Research concerning using animal models that may ultimately benefit the health and well-being of human beings continues to receive substantial but not unequivocal support. Rather, considerable ambivalence driven by attitudes, personality characteristics, and misperceptions about animal research continue to exist. In the present study, individuals comprising various sectors of the academic community (undergraduate and graduate students, faculty, and staff) as well as recruits from the general population were presented with a mock research proposal that varied by goals and species. As part of a fictitious Institutional Animal Care and Use Committee (IACUC), the participants were asked to review the protocol and render a decision to either approve or reject the research proposal. In addition, the participants were queried about the perceived importance of the project, the suffering of the animals, and the amount of perceived scientific detachment from the animals. Lastly, the participants answered a series of items from a research-derived Perceptions about the Use of Animals Scale and the Emotional Intelligence Scale (EIS). Consistent with other research, female respondents were much less accepting of the research protocols than males. Protocol approval rates varied by the research objectives and the species, with research projects seen as having lower biomedical value such as psychology student training and the use of certain species (chimps & cats), generally receiving less support. The ethical issues associated with the use of animals in experiments is briefly considered as well as the need for additional messaging on role of animal research, particularly in the behavioral sciences.

Keywords: *animal research, animal rights, emotional intelligence, biomedical research, behavioral research, attitudes*

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1. Introduction

While not a new issue, vigorous debate persists about the acceptable use of nonhuman animals [1]. For example, recent controversies have led to substantive changes in policy such as SeaWorld's decisions to stop orca breeding and phase out orca shows after intense public pressure following the release of the documentary film Blackfish [2,3]. While significant arguments have been made about the continued need for animal models, research employing animals as subjects remains a contentious issue [4,5,6].

Respondent characteristics that influence attitudes toward animals and their use include age [7-12] and gender [7,10,13,14,15]. Of these, gender has been a stable and robust finding, with women holding more favorable attitudes toward animals - and thus, less favorable attitudes toward their use in research - than men. Perhaps it is unsurprising that such differences are translated in greater female involvement in animal welfare and animal rights issues [16], with female activists outnumbering their male counterparts by ratios as high as three to one [1,17,18,19]. Unfortunately, what drives this gender difference remains largely illusive [20].

In our own prior research [21], educational attainment and concomitant experiences were associated with greater acceptance for the use of animals in research, an observation reported by others [22,23,24]. However, these findings were at odds with those reports from other investigators [25,26]. At any rate, generally lower levels of education are correlated with higher concern for animal welfare [27,28,29]. When college students are considered, the chosen academic major is associated with the degree of acceptance of animal research [13,23,30] as is academic rank [31]. Perhaps unsurprisingly, those majoring in the sciences see animal research in a more favorable light than those in the humanities [13,23,30]. However, bolstered by their belief system and values, students may self-select majors where animal research is not a part of the curriculum [31].

Finally, among the factors that influence individual responses toward animals and the acceptability of their use for utilitarian purposes is how the animal species under consideration is typically perceived. Animals that are considered beautiful, cute or rare, for example, are perceived more favorably than species not typically described using such adjectives [32]. In two studies, psychology majors and psychologists endorsed stronger opposition to invasive research that involved nonhuman primates or dogs than when the research subject was a rodent or bird [25,26]. Further, pet ownership is considered an important predictor of the vigor of human concern for animal welfare [7,33].

One variable that appears to weigh heavily in participant attitudes toward animal research concerns the type of research activity [1]. As seen in popular culture with the rise of "cruelty free" retail outlets such as the Lush franchise [34], support for cosmetic research using animal models is significantly lower than for biomedical research [7,15,21,35-37]. Psychological research using animal models is considered less valuable, driving down support for the use of animals in the behavioral sciences [15,21]. The animal rights organization People for the Ethical Treatment of Animals has been effective in using social media with more than 5 million "likes" [38] and such organizations may exert a marked influence on public perception of animal research generally and specific types of research activities in particular.

Laws regarding the use of animals as research subjects differ by country. This extends to the species that are covered as animals. In the United States, under the Animal Welfare Act, animals are defined as:

> . . . any live or dead dog, cat, nonhuman primate, guinea pig, hamster, rabbit, or any other warmblooded animal, which is being used, or is intended for use for research, teaching, testing, experimentation, or exhibition purposes, or as a pet. This term excludes birds, rats of the genus Rattus, and mice of the genus Mus, bred for use in research; horses not used for research purposes; and other farm animals, such as, but not limited to, livestock or poultry used or intended for use as food or fiber, or livestock or poultry used or intended for use for improving animal nutrition, breeding, management, or production efficiency, or for improving the quality of food or fiber. With respect to a dog, the term means all dogs, including those used for hunting, security, or breeding purposes [39].

In the United States, federal law governing animal protection is in the Code of Federal regulations (CFR) as well as the Public Health Service (PHS) policy on Humane Care and Use of Laboratory Animals. Collectively, these regulations call for the establishment of Institutional Animal Care and Use Committees (IACUCs). Each research facility, whether public or private, has its own committee and PHS policy requires that the institution adhere to guidance from the Guide for the Care and Use of Laboratory Animals [40]. The members of the IACUC, ranging from as few as six to more than a dozen, are charged with the responsibility of reviewing all animal research protocols before the project is permitted to begin. While a detailed examination of the duties of an IACUC are beyond the scope of this paper, the committee has significant responsibilities to ensure that the protocol is justified by the scientific merit of the proposal, that harm is minimized, and that appropriate veterinary care (both pre- and post-operative) is assured (including the appropriate use of analgesics). In addition, an IACUC has the authority to suspend any research that is being conducted outside of the approved protocol or if ethical and regulatory standards have been violated.

Emotions are a normal part of life for all human beings and the questions regarding the use of animals in research arguably are quite emotional in nature. However, considerable individual variation exists in terms of the intensity and variety of emotions human beings experience and what a given individual considers most relevant [41]. In addition, how we use affect-laden information that is of an intra-personal (e.g., management of one's own emotions) or interpersonal (e.g., managing the emotions of others) nature is highly variable. Simply put, some individuals are more adept in perceiving, communicating, and using emotions [42].

Based on the framework of Mayer and Salovey [42], Schutte and colleagues created a brief self-report measure of emotional intelligence (EI), designed as a simple self-report measure of global EI [43]. While EI has been primarily utilized in human interaction, it would seem reasonable to consider management of the individual's personal emotions when exploring the variables that drive personal responses related to the use of animals in research.

The purpose of the present investigation was to determine the variables that are predictive of participant decisions in an IACUC setting. Participants were randomly assigned to one of four different research protocols with one of four different research species. Through this, we sought to determine how consideration of the hypothetical animal research projects were affected by (1) the research protocol, (2) the proposed species as a research subject, (3) demographic variables and subject characteristics such as age, race, and gender, the education and the emotional intelligence of the participant, and (4) responses from the subscales derived from a Perceptions about the Use of Animals Scale. In addition, the potential contributions of the evaluator's perceived importance of the research project, the perceived pain and suffering of the animals, and the perceived level of researcher dissociation from the research subjects were explored.

2. Method

2.1. Participants

A total of 614 individuals participated in the present study. The sample included both college students (N = 542) and faculty or professionals in the community (N = 72), most of whom were enrolled or teaching at an urban mid-sized private university located in the southeastern United States. The majority of the students were either enrolled as full-time undergraduates in a traditional day programs or graduate students enrolled in a graduate pharmacy (PharmD) program. Twelve of the 614 individuals failed to disclose their gender. Of the remaining 602, 64.8% identified as female. Fifty-seven percent of the sample identified as Caucasian/White, 9.6% as African-American or Black, 19.9% as Hispanic, with the remaining participants identifying as Asian/Pacific Islander or of Indian decent. The age of the respondents ranged from 17 to 64 (Median = 24). While 8.5% identified as an animal rights activist (N = 62) or an animal welfare activist (20.6%, N = 150), the majority of the sample (55.2%, N = 402) identified as neither. The majority of the participants were raised with pet animals (93.2%) and, interestingly, a substantial minority with or near farm animals (40.4%). All participation was voluntary, with the majority not receiving any course credit (if applicable) for participation.

2.2. Materials and Procedure

All data was collected electronically using Survey Monkey. Participants were recruited in various psychology classes, by student or staff email listservs, or by Facebook advertisement. Questions included demographic information about the respondent, personal views about and the feelings toward the use of animals in research and for teaching purposes, and a series of items about the beliefs of the individual. Written instructions were provided with each questionnaire, and the respondents were told not to provide additional information or discuss the items with others. Respondents were informed that their responses would remain anonymous and confidential.

2.2.1. Design

The experimental design included four different research protocols (see below) that varied by four different species – one genetically similar to humans (chimps), a common pet animal that is sometimes used in research (cats), a common rodent research model (rats), and a nonmammalian amphibian model (frogs). The protocol and species were randomly chosen for each participant by a computer algorithm as part of the Survey Monkey software. Thus, the primary experimental design and associated dependent measures consisted of a completely randomized 4 (research protocols) X 4 (animal species) design.

2.2.2. Emotional Intelligence Scale (EIS)

Based on a model first proposed by Salovey and Mayer [44], the Emotional Intelligence Scale consists of 33 item Likert scale statements [43]. The EIS has good discriminative validity, proving to be different from cognitive abilities. The EIS measures differing dimensions that include the use of emotions, the sharing and experience of emotions, appraisal of emotion (evaluation and expression of emotions in oneself and others), and mood regulation (emotional regulation in oneself and that of others).

2.2.3. Perceptions about the Use of Animals Scale (PUAS)

A series of statements about the use of animals in different situations as well as items about areas such as animal perception of pain, animal cognition, and self-awareness comprised the scale. The items were adapted from general questions found throughout the literature as well as in internet discussions.

Assessment of the underlying psychometric characteristics of the scale and reliability were considered as part of the preliminary data analysis process. Principal component analysis (PCA) was used because of its simple but exact mathematical logic [45]. Specifically, the PCA with varimax rotation was conducted on the 22 items that were designed to assess respondent (N = 388) perceptions of various types of research, the use of animals as well as their place in society, and aspects of spirituality. The resulting analyses revealed an adequate sample (KMO = .804) [46]. Item loadings, with values greater than 0.3, were used to describe the components [47]. The analysis revealed four factors with eigenvalues over Kaiser's criterion of 1, collectively and in combination explaining 52.15% of the variance. A table showing the factor loadings after rotation is presented in the Supplementary Materials section. Following rotation, items clustering on the same factor suggested that factor 1 represented an Animal Spirituality and Rights subscale (7 items), factor 2 a Use of Animals in Research subscale (5 items), factor 3 represented an Animal Thought and Pain Perception subscale (5 items), and the 4th factor represented an Animal Self-Awareness and Evolution subscale (5 items). The Animal Spirituality and Rights, Use of Animals in Research, and Animal Thought and Perceived Pain subscales had high reliabilities (Cronbach's α = .84, .78, & 71). However, the Animal Self-Awareness and Evolution subscale had relatively low reliability (Cronbach's α = .58).

2.2.4. Instructions to the Research Participants

Before reviewing the research proposal, all participants received the same instructions.

All institutions receiving federal funding for scientific research must have an active Institutional Animal Care and Use Committee (IACUC) to review and approve or deny all research conducted at the institution.

Pretend that you are a member of such a committee at Palm Beach Atlantic University. It is your responsibility to approve or reject research proposals submitted by faculty members who want to use animals for research or instructional purposes in psychology, biology, etc. The proposal that follows describes an experiment, including the goals and potential benefits of the research as well as any discomfort or injury that the animals may experience. You must either approve the research or deny permission for the experiment to proceed.

It is not your job to suggest improvements in methodology and/or design. After reading the proposal, make your decision on the basis of the information given in the proposal (approve or deny) and answer all of the questions beginning on the next page.

2.2.5. Research Protocols

Protocol 1 – Xenotransplantation. A thorny proposal has come before your committee. Dr. Baker is a world-renowned immunologist and researcher. He is particularly interested in therapeutic uses of the thymus gland to bolster immune system defenses. The thymus is a specialized organ of the immune system. Within the thymus, T-cells mature. T cells are critical to the adaptive immune system, where they adapt specifically to foreign invaders. The thymus is largest and most active during the neonatal and pre-adolescent periods. By the early teens, the thymus begins to atrophy and is mostly replaced by adipose (fat) tissue. Nevertheless, residual T development continues throughout adult life.

While healthy thymus gland tissue can successfully be transplanted into the body of a person with a compromised immune system, there is a severe shortage of young donors. A compromised immune system is a cause of death in many people around the world. Dr. Baker has tried to develop an artificial thymus gland. Unfortunately, these have not been as successful as hoped. He now wants to try a novel approach - transplanting the thymus gland tissue of 10 [species] into a human host.

He proposes to implant the thymus tissue from 10 six-month-old healthy male [species] into the chest of Fred Jones, a 68-year-old man who is dying due to a compromised immune system. Mr. Jones will almost certainly die within two months if the transplantation experiment is not performed. He has been informed that the procedure is very risky and that he may die or have a reduced quality of life following the surgery. He has also been informed that the procedure is entirely experimental. Mr. Jones has agreed to the surgery. He says he is doing it not to extend his own life but to advance science so that in the future, others might benefit from receiving such xenotransplantations.

Dr. Baker argues that this experiment, even if unsuccessful, will be of ground-breaking importance and lead to the development of technologies that will permit the use of animal tissues to supplement the lives of human beings.

Your group needs to approve or reject the project from an animal care perspective.

(The human subjects committee will review the human ethics aspect of the research.)

Protocol 2 - Psychology (Demonstration/Teaching Experiment). The Psychology Department is requesting permission from your committee to use 10 [species] per semester for demonstration experiments in a biological psychology course with laboratory. Thirty students, working in groups of three, will be given a [species]. First, the students will perform surgery on the [species]. Each animal will be anesthetized. Following standard surgical procedures, an incision will be made in the scalp and two holes drilled in the skull. Electrodes will be lowered into the brain to create lesions on each side. The animals will then be allowed to recover. Several weeks later, the [species] will be tested in a shuttle avoidance task in which the animals will learn when to cross over an electrified grid, as a mechanism to assess the effects of destroying this part of the [species]'s brain.

The instructor acknowledges that the procedure is a common demonstration and that no new scientific information will be gained from the experiment. She argues, however, that students participating in a course in biological psychology must have the opportunity to engage in animal surgery and to see firsthand the effects of brain lesions.

Protocol 3. Nature/Nurture (Limb Amputation). Dr. Smith is investigating one of the oldest issues in psychology - the nature-nurture issue (learning vs. instinct). She studies the degree that complex behaviors are under genetic control. She wants to investigate the complicated series of movements [species] use to groom themselves. Some researchers argue that this sequence of behaviors is learned. They think [species] teach themselves the grooming movements by repeating behaviors that just happen to get rid of dirt or debris. Smith, in contrast, believes that grooming in [species] is a clear example of an instinct. She believes these behaviors can develop with no practice or experience. She thinks that the grooming movements are genetically "hard-wired" into the brain from birth.

Smith has designed an experiment to test which of these theories is correct. She proposes to deprive newborn [species] of the opportunity to learn the grooming behavior patterns by amputating their forelimbs, leaving short stumps. Twenty [species] will be used in the experiment. The 10 [species] in the experimental group will be anesthetized the day after they are born and their front limbs painlessly amputated. The 10 [species] in the control group will be temporarily anesthetized but their limbs will not be amputated. All the animals will be hand-reared by humans.

The [species] will be observed on a regular schedule using standard observation techniques. Any grooming movements will be filmed and analyzed. If grooming is a learned behavior, the [species] in the experimental group should not make grooming movements with their stumps as they would have no effect on removing dirt or debris. However, if the grooming movements are instinctive, the [species] should exhibit grooming movements with their stumps at the same age that they appear in the control group [species].

In her proposal, Dr. Smith notes that understanding the genetic basis of [species] behavior cannot be directly applied to humans. However, she argues that the experiment will resolve an important debate over existence of instincts in living animals that is related to humans. She also argues that the study will shed insight into the role of genes in brain development. Finally, she stresses that the amputations are painless, and the [species] will be well-treated after the operation.

Protocol 4. Donor Stem Cells (Potential Alzheimer's Disease Treatment). Professor King is working in a new and exciting research area of science, brain grafts. Induced pluripotent stem cells (also known as iPS cells or iPSCs) are a type of pluripotent stem cell that can be generated directly from adult cells (not embryos) and have the capacity to become any type of cell including neurons. Could induced pluripotent stem cells be implanted into adults who have suffered brain damage? And would these cells develop into neurons that make the proper connections and repair the damage? Dr. King wants to transplant induced pluripotent stem cells from donor adult [species] into the brains of recipient [species], specifically into the entorhinal cortex. In humans, this area is involved in Alzheimer's disease.

She proposes to use 20 adult [species] as the subjects. First, all the [species] will be subjected to surgery in the entorhinal cortex. This procedure will involve anesthetizing the animals, opening their skulls, and removing part of the brain. After they recover, the [species] will be tested on a learning task to make sure their memory is impaired. Three months later, half of the [species] will be given transplant surgery1. Adult Induced pluripotent stem cells will be implanted into the entorhinal cortex of the brain damaged [species] in the experimental group. All the [species] will then be taught a new task to test the hypothesis that the [species] with brain grafts will show improved memory and perform better than the [species] in the control group that did not get the stem cells.

Dr. King argues that this research is in the exploratory stages and can only be done on animals. She notes that millions of Americans have Alzheimer's disease and declares that this research could lead to treatments that would reverse the devastating memory loss that human Alzheimer's victims suffer.

3. Results

As noted earlier, the respondents were as young as 17 with the oldest 64 years old. Nonetheless, the median age (24) was that of young adults. Only 8.5% considered themselves animal rights activists (N = 62), with 20.6% considering themselves animal welfare activists (N = 150). Interestingly, 55.2% of the sample (N = 402) identified as neither. However, the vast majority (93.2%) of the participants were raised with pet animals, with over 40% raised with or near farm animals of some type.

Next, the role of gender in protocol approval and gender in consideration of species were examined. The relationship between gender and protocol approval rate was significant, $\chi 2$ (3, N = 602) = 31.02, $p < .001$, $\Phi C = .227$. While only 47.9% of females would approve the protocol, 75.4% of male respondents would do so. This pattern persisted across all four protocols, although approval rates for both males (40%) and females (10%) were less than 50% when the nature-nurture protocol was considered, $\chi 2$ (1, N = 100) = 10.71, $p < .01$, $\Phi C = .327$. When the relationship between gender and protocol approval rate was considered by species, females were much less likely to approve a protocol using chimps (22.7%) than males (80%), $\chi 2$ (1, N = 108) = 24.06, $p < .001$, $\Phi C = .472$. This was the case for rats as well, $\chi 2$ (1, N = 152) = 26.64, $p < .001$, $\Phi C = .419$.

Following the examination of gender, the data associated with the four species were considered within each research protocol. First, as seen in Table 1, the relationship between protocol and review decision was significant, $\chi 2$ (3, N = 614) = 105.42, $p < .001$, $\Phi C = .414$. Subsequent multiple comparisons using Ryan's procedure [50] revealed the following differences. The respondents were significantly more likely to approve the xenotransplantation than the psychology laboratory training and nature-nurture protocols. The proportion approvals when the brain grafting protocol was considered was similar to that of the xenotransplantation protocol. The nature-nurture protocol was viewed least favorably, with rejection rates higher than that of the three other protocols.

Consideration of species within each protocol revealed the following. The relationship between species and review decision was significant for the psychology, $\chi 2$ (3, N = 132) = 39.82, $p < .001$, $\Phi C = .55$, nature-nurture, $\chi 2$ (3, N = 104) = 17.73, $p < .01$, $\Phi C = .41$, and donor stem cells, $\chi 2$ (3, N = 112) = 8.09, $p < .05$, $\Phi C = .27$, protocols. Conversely, when examined within the context of the xenotransplantation protocol, the relationship between the species and approval decision was nonsignificant. Subsequent multiple comparisons revealed the following with one caveat. As shown in Table 1, the approval frequency with chimps in the nature-nurture protocol was 0, violating an assumption of the chi-squared test [51]. While acknowledging this, we felt it was best to continue to examine the proportions within each protocol. For the Psychology protocol, when rats and frogs were to serve as subjects, approval rates were significantly higher than when chimps or cats were the proposed research subjects, where the proportions for the latter two were comparable (see Table 1). When the nature-nurture protocol was considered, only the proportion of approvals for chimps (0%) differed from that of cats. Although some variability in proportions among the other three species was observed, such differences were nonsignificant. When the donor stem cell protocol was considered, the respondents were significantly more likely to approve the protocol when cats or rats were the research subjects than when chimps and, oddly, frogs where the proposed subjects.

Table 1. Proportion of Individuals Who Approved Versus Denied One of Four Possible Protocols with One of Four Possible Proposed Research Subjects

Research Protocol & Species	Approved	Denied
Xenotransplantation^{a}	69.9%(186)	30.1%(80)$_{b,c}$
Chimps^{e}	80.0%(16)	20.0%(4)
Cats^{f}	65.5%(114)	34.5%(60)
Rats^{g}	78.6%(44)	21.4%(12)
Frogs^{h}	75%(12)	25%(4)
Psychology Lab Training^{b}	37.9%(50)$_{a,d}$	62.1%(82)$_{c}$
Chimps^{e}	0%(0)$_{g,h}$	100%(20)$_{g,h}$
Cats^{f}	11.1%(4)$_{g,h}$	88.9%(32)$_{g,h}$
Rats^{g}	59.1%(26)$_{e,f}$	40.9%(18)$_{e,f}$
Frogs^{h}	62.5%(20)$_{e,f}$	37.5%(12)$_{e,f}$
Nature-Nurture^{c}	19.2%(20)$_{a,b,d}$	80.8%(84)
Chimps^{e}	0%(0)$_{f,g,h}$	100%(32)$_{f}$
Cats^{f}	50%(8)$_{e,h}$	50%(8)$_{e}$
Rats^{g}	25%(4)	75%(12)
Frogs^{h}	20%(8)	80%(32)
Brain Grafting^{d}	71.4%(80)	28.6%(32)$_{b,c}$
Chimps^{e}	55.6%(20)$_{f,g,h}$	44.4%(16)$_{f,g}$
Cats^{f}	85.7%(24)$_{e}$	14.3%(4)$_{e}$
Rats^{g}	77.8%(28)$_{e,f}$	22.2%(8)$_{e}$
Frogs^{h}	66.7%(8)	33.3%(4)

Note. Superscripts designate each protocol or species. Subscripts represent a significant comparison of proportions between the four protocols (a-d) or the four species within each protocol (e-h).

Next, using a 4-protocols X 4-species MANOVA, the ratings of the perceived importance of the proposal, perceived level of pain and suffering the animals might endure, and the perceived level of researcher dissociation from the effects of the protocol on the animals we explored. The resulting data are presented in Figure 1. Consideration of these data revealed the following. The multivariate main effect of research protocol was significant, Wilk's λ = .606, approximate F(9, 1562.61) = 39.74, $p < .001$, $\eta p^2 = .154$, as was the multivariate main effect of species, Wilk's λ = .942, approximate F(9, 1562.61)

= 4.31, $p < .001$, $\eta p^2 = .020$. These results suggested perceived differences as both a function of the research protocol and the proposed species serving as research subjects. Post hoc examination of the means revealed that the respondents considered the xenotransplantation and donor stem cell projects of greater importance than the psychology training or nature-nurture study. Here, the psychology protocol was seen as of significantly less value than the other three protocols, with the xenotransplantation and donor stem cell protocols considered equally valuable. Perceived animal pain and suffering was significantly lower when the xenotransplantation and the nature-nurture studies were considered than in ratings of the psychology training and donor stem cell protocols. Last, with the exception of the comparisons of the mean of the xenotransplantation and nature-nurture studies with the mean of the former significantly higher, rated researcher levels of scientific detachment were comparable.

More important, a research protocol X species interaction was found, Wilk's $\lambda = .861$, approximate $F(9, 1875.61) = 3.67$, $p < .001$, $\eta p^2 = .049$. Decomposition of this interaction revealed the following. For the xenotransplantation protocol, the effect of species was nonsignificant, Wilk's $\lambda = .964$, approximate $F(9, 384) = 1.07$, $p > .05$. On the other hand, a multivariate effect of species was found when considered within each protocol, smallest Wilk's $\lambda = .071$, approximate $F(9, 98) = 429.02$, $p < .001$, $\eta p^2 = .10$. When the psychology protocol was considered, species differences were observed on the perceived animal pain and suffering, the researcher scientific detachment measure and the protocol importance measure (see Figure 1). When chimps or cats were the proposed subjects, the respondents rated the importance of the protocol significantly lower than when rats or frogs were the proposed subjects. As shown in Figure 1, frogs were perceived as suffering significantly less than any of the mammalian species, with the means of the latter three comparable (Fisher's LSD, $ps > .05$). Interestingly, when researcher scientific detachment was considered, differences between chimps and the two other mammalian species were observed but not for frogs.

Closer examination of a significant species effect within the Nature-Nurture protocol revealed the following. First, the protocol was rated as significantly less important if frogs were the proposed research subject rather than chimps or cats. When rats were a part of the research protocol, all comparisons were nonsignificant. Chimps were perceived as suffering more than frogs but the remaining comparisons were nonsignificant. Last, the respondents rated the researcher level of dissociation higher when using cats than for the other three species which oddly, did not differ.

The final protocol included donor stem cells. If chimps were the proposed subject, the respondents rated the importance of the study significantly lower than when the other three species were considered. Here, the importance ratings for the latter three species were comparable. Both rats and chimps were perceived as experiencing greater pain and suffering than cats and frogs. Surprisingly, perceived suffering among frogs was rated higher than that of chimps. Last, the respondents rated greater levels of researcher scientific detachment when cats and frogs served as research subjects than chimps or frogs were used.

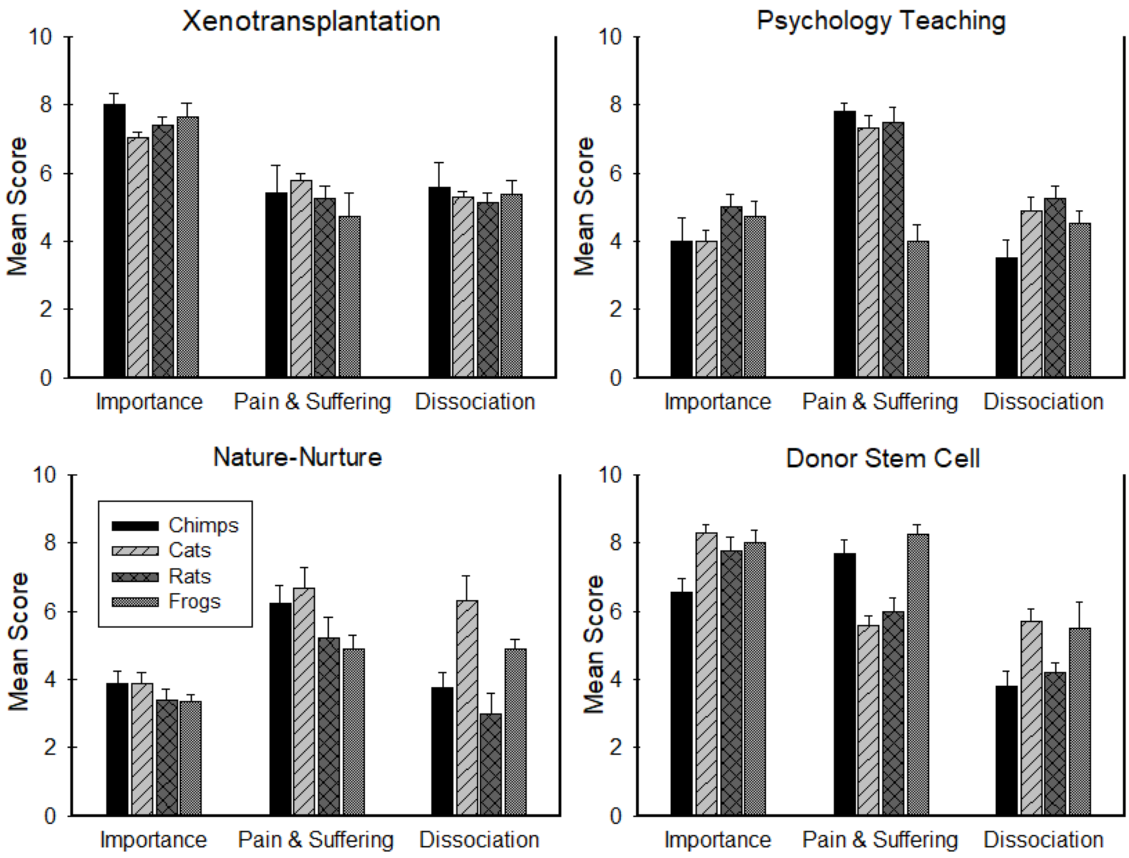

Figure 1. Means and standard error of the mean (SEM) for the protocol importance, perceived animal pain and suffering, and perceived level of researcher scientific detachment (dissociation) from the animals for the 4 research protocols (see text)

In order to determine what measures were predictive of the decision of the respondents, a bivariate forward and backward stepwise logistic regression was used. Yielding similar results, the backward stepwise logistic regression with Approve or Deny as the dependent variable is considered here. Potential predictor variables used in the analyses included age, sex (female as the indicator variable), race (white as the indicator variable), education, protocol (donor stem cells protocol as the indicator variable), species (frogs as the indicator variable), EQ score, importance of the proposed study, perceived pain and suffering, perceived dissociation by the researcher, and the first three subscales from the PUAS derived from the preliminary data in the present study. A test of the resulting final fitted model versus a model with intercept only was statistically significant, $\chi 2(16) = 361.05$, $p < .001$, Nagelkerke $R^2 = 0.675$. The model was able to correctly classify 89.1% (n = 230) of protocol approvals and 85.4% (n = 222) of protocols that were denied with an overall accuracy of 87.2%. Further information concerning the results of the bivariate logistic regression including logistic regression coefficients, Wald test, and odds ratios, is presented in Table 2. Age, education, one of race dummy variables, two of three of the protocol dummy variables, two of the three species dummy variables, and the Use of Animals in Research subscale made significant contributions to the equation.

Table 2. Logistic Regression Predicting Protocol Decision on the Basis of the Subject Characteristics, and Species

Predictor	*B*	Wald χ^2	*p*	Odds Ratio	CI
Age	-.849	15.06	< .001	.428	.28-.66
Education	.236	4.51	.024	1.27	1.02-1.57
Race		8.79	.034		
Race	.593	1.26	.261	1.76	.66-4.71
Race	1.219	7.59	.006	3.41	1.43-8.16
Race	-.052	0.18	.672	.811	.31-2.13
Protocol		17.37	.001		
1	.501	1.05	.307	1.65	.74-3.68
2	1.461	7.63	.005	4.12	1.53-11.13
3	2.418	17.34	< .001	11.23	3.36-37.56
Species		7.81	.050		
1	1.128	4.45	.035	3.09	1.08-8.80
2	1.461	6.78	.009	4.31	1.44-12.94
3	.698	1.58	.209	2.01	.68-5.97
Importance	-.527	37.31	< .001	.590	.49-.69
Pain-Suffering	.405	34.55	< .001	1.51	1.31-1.72
Scientific Detachment	-.198	10.43	.001	.821	.73-.93
EQ	.022	5.44	.020	1.022	1.01-1.04
Research	.060	6.65	.010	1.062	1.02-1.11

Note. B = unstandardized partial regression coefficient, CI = confidence interval. Dependent variable was the decision concerning the protocol (0 = Yes, 1 = No). Independent variables: Age, Gender (0 = Female, 1 = male), Race (0 = Caucasian, 1 = Black/African-American, 3 = Latino/Hispanic, 4 = Other). Protocol (1 = Xenotransplantation, 2 = Nature/Nurture, 3 = Psychology, 4 = Brain Graft), Perceived importance of the study, Perceived level of pain and suffering, Perceived level of researcher scientific detachment, Emotional Intelligence, and the Use of Animals in Research subscale of the PUAS.

Considering the influence of the protocol on the decision while holding all other variables constant, the respondents were more than 11 times more likely to approve the donor stem cell project than the nature-nature project and 4.12 times more likely to approve the donor stem cell project than the psychology project. The remaining protocol, xenotransplantation was not predictive ($p > .22$). Species, too, was predictive with the respondents 3.09 to 4.32 times more likely to approve the research protocol if frogs were used than if chimps or cats were used. As a species, rats did not contribute significantly to the equation.

When the demographic variables were considered, the following emerged. First, inverting the odds ratio for age reveals that for each unit increase in age, there is an approximate doubling of the odds that the participants will approve the research project. Caucasian respondents were almost 3.5 times more likely to approve the research protocol than Hispanic/Latino individuals. Education was a significant predictor as well, albeit with a more modest odds ratio of 1.27. Interestingly, gender was not a significant contributor to the regression and not in the final model.

Although significant, smaller effects were observed for the Use of Animals in Research subscale (O/R = 1.06). As noted earlier, the other subscales were nonsignificant and not considered in the final regression model. The perceived amount of animal pain and suffering was significant with a one-point increase on the 10-point scale associated with the odds of rejection increasing by a factor of 1.50. Inverting the odds ratio for the perceived importance of the protocol indicated that for each 1-point increase on the importance measure, the odds that the protocol would be approved increased by 1.69. Similarly, although smaller, the perceived level of researcher scientific detachment impacted the odds that protocol would be approved. Here, however, the respondents might have had more difficulty rating the amount of dissociation with higher protocol rejection rates associated with low and high levels of perceived researcher scientific detachment or dissociation.

4. Discussion

As noted theologian C S. Lewis [52] remarked,

It is the rarest thing in the world to hear a rational discussion of vivisection. Those who disapprove of it are commonly accused of "sentimentality," and very often their arguments justify the accusation. They paint pictures of pretty little dogs on dissecting tables. But the other side lie open to exactly the same charge. They also often defend the practice by drawing pictures of suffering women and children whose pain can be relieved (we are assured) only by the fruits of vivisection (p. 224).

It is clear that research involving animal models have produced advances in the biomedical arena [53,54] as well as progress in behavioral research [55,56]. For example, 96 of 108 Nobel Prizes in Physiology or Medicine were for work where animals were an integral part of the research process [57]. Not surprisingly, experimentation using nonhuman animals as research subjects is big business [58]. The public appears to be engaged on the issues, with one recent survey suggesting that 33% of people are very concerned about animals used for research purposes, while only 21% very concerned about zoo animals. In addition, 32% of those polled believe in equal rights for humans and animals, a 7% increase from a survey performed seven years previously [59].

We anticipated that the donor stem cell protocol, with clear relevance to many of the participants, would have higher approval rates and that was indeed the case (71.4%). The xenotransplantation protocol was close behind with an overall approval rate of almost 70%. While arguably all four research scenarios could involve research in the behavioral sciences, three of the four were more biomedical in nature. The psychology training scenario was considered less important the xenotransplantation or tissue grafting protocols, yet fared somewhat more favorably than the nature-nurture protocol. Since animal research will remain a part of psychology for the foreseeable future [60], the discipline may need to do a better job explaining the need for such research and training. For example, animal models have produced important insights into both the putative causes and possible interventions for many psychological and neurological disorders, ranging from Alzheimer's disease and Schizophrenia to anxiety disorders, obsessive-compulsive disorder, and the indicators and determinants of substance abuse [61].

A number of factors may drive the perceived value of the psychology teaching/training protocol relative to the protocols with a clearer link to biomedical research. While the sample did include a substantial number of undergraduate students, even among psychology majors there may well have been an inadequate level of knowledge about the role of animal research in behavioral research. For example, Domjan and Purdy [62] found that introductory psychology textbooks presented an impoverished view of the role of animal research in increasing our understanding of similar processes in humans. Interestingly, a nontrivial number of landmark investigations with animals as subjects were described in a manner that would lead the reader to conclude that the results were from studies with human participants. In a subsequent study, Baker [63] found a similar pattern among most introductory texts. Here, only about 5% of the total material on average involved a discussion of research using animals as subjects or even animal behavior. Eaton and Sleigh [64] reported even less material in a consideration of developmental psychology texts. Such presentations of important psychological concepts minimize the importance of the myriad of behavioral, biological, and neurological similarities shared across human and nonhuman species [65], including the complexity of learning and memory processes [66] and animal cognition [67]. Currently, the psychology major at the institution where the majority of the data was collected does not require work in courses that highlight animal research contributions.

As the present results and that of others suggest [7-15] the attitudes toward the use of animals in research and experimentation are multidimensional [22]. Individuals exposed to relevant information including the "three Rs" of animal research – refinement, reduction and replacement – may have a deeper appreciation of and more positive views about animal research [22,23,24,31], with fewer false beliefs [22,68]. Unfortunately, as noted by others [31], while useful, science education may have little impact on individual perceptions of research with animals [69]. Nevertheless, the results of Gabriel and colleagues [31] are promising in this regard.

Of course, not all research is of equal value and this includes research using animal models. Nonetheless, when appropriate statistical tools and research design principles are brought to bear and implemented, animal research still appears to be of value in the advancement of theory as well as in practice [70].

Thus, the issues that surround the use of animals for research purposes are both complex and include legal, financial, moral, and ethical issues [71-77]. While the competing narratives cannot be settled here, there are guiding principles that may prove valuable. First, by the very nature of the empirical research process, all behavioral, neurobehavioral, psychopharmacological, and biomedical knowledge is cumulative. Data derived from animal models are considered alongside data using tissue models, data collected using human subjects, and computer modelling [70]. Briefly, justifications for the use of animals, especially protocols where suffering, often leading to death, require the examination of two main considerations. According to Carbone [70], the first consideration deals with judgments concerning harming animals for human benefits. Such considerations involve moral justification, often referred to as the speciesism justification. Equally important, any animal research under consideration must have a reasonable expectation that the project will produce empirically valid knowledge – knowledge that cannot be ethically obtained in other ways - that is useful in furthering our knowledge, including our understanding of human maladies and potential treatments. This latter consideration is often referred to as utility justifications [40,70]. Ideally, an effective IACUC incorporates these as part of the review process.

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Supplementary Material

Summary of the Principal Components Analysis with Varimax Rotation Results for the Perceptions about the Use of Animals Scale (N = 388)

Item	Animal Spirituality and Rights	Use of Animals in Research	Animal Thought and Pain	Animal Self-Awareness and Evolution
Humans have a soul but animals do not.	.783			
People have a life after death animals do not.	.767			
The needs of people should always come before the needs of animals.	.730			
People are superior to animals.	.730			
People have a spiritual nature but animals do not.	.712			
It's okay to use animals to carry out tasks for humans.	.488			
Animals should have the same rights as human beings.	-.397			
Humans have a soul but animals do not.	.783			
Medical research that involves the use of animals is usually unnecessary.		.842		
Animal research, regardless of potential contribution, cannot be justified and should be prohibited by law.		.767		
A _____ percentage of research with animals provides important information that helps human beings.		.734		
Psychology research that involves the use of animals is usually unnecessary.		.649		
Cosmetics research that involves the use of animals is usually unnecessary.		.454		
I am concerned about the pain and suffering in animals used in surgical and experimental situations.			.805	
I am concerned about the pain and suffering in animals used in nonsurgical and nonexperimental situations.			.745	
I believe that when subjected to painful stimuli, animals suffer as much as people.			.609	
It's crazy to think of an animal as a member of your family.			-.548	
Humans can think but animals cannot.			-.510	
Animals are afraid of death.				.663
People are animals.				.599
People evolved from lower animals.				.545
An intrinsic interest in an animal for the sake of knowledge is usually justification for doing animal research.				.532
Animals can fall in love.				.372
Eigenvalues	3.89	3.22	2.59	1.77
% of variance	17.70	14.62	11.78	8.05
Cronbach's α	.841	.778	.707	.557