COGNITIVE DISSONANCE AND STRESS EXPERIENCED IN LABORATORY ANIMAL PROFESSIONALS AND -TECHNICIANS

by

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Abstract

This study examined the amount of experienced stress and cognitive dissonance in laboratory professionals and -technicians. Laboratory animal veterinarians and -technicians were compared to laboratory professionals and -technicians in human research and non-animal laboratory professionals and -technicians. Participants were asked to fill out a questionnaire which differed in measurement scales depending on which group they were in. The participants were asked questions regarding attitude, behaviour, cognitive dissonance, enrichment, stress, depression, and anxiety. The final sample consisted of 70 participants. The veterinary-research group consisted of 24 participants, the human-research group of 18 participants, and the non-animal group of 28 participants. The results indicated that there were no significant differences between the groups on the experienced amount of stress. Additionally, no differences were found between the veterinary-research group and human-research group in the amount of experienced cognitive dissonance. Furthermore, the results did show a significant positive relationship between cognitive dissonance and stress. On top of that, a significant negative relationship was found between enrichment and cognitive dissonance. However, since the sample size of this study was small, it is recommended to conduct further research with larger sample sizes.

Introduction

Animals in our society are used in many different ways; for example, they are used for food, clothing, research, education, companionship, and entertainment. The debate on human-animal relationships and the ethical issues that come with it, have been a focus of interest in society from prehistoric time until the present (Szücs et al., 2012). However, our contemporary society is changing, and with it, the perspectives on animals within our society. For instance, the use of wildlife for entertainment has been declining over the past decades, growing numbers of psychologists have been questioning the ethical appropriateness of animal research, and regulations have been designed over the years to protect the welfare and usage of laboratory animals (Plous, 1993). An important factor to take into account in these ethical discussions around animal welfare, is the concept of 'speciesism'. Speciesism can be defined as the "differential treatment (behavioral) and moral evaluation (attitudes and beliefs) of animals merely based on their species membership" (Dohnt et al., 2020, p. 30). Humans tend to distance themselves from other species and view themselves as the superior species. In accordance, animals are being valued by humans based on their functional or cultural role, which reflects the self-interests of humans. This prejudicial thinking provides us with moral justification for the utilization and abuse of animals (Dohnt et al., 2020).

This paper has a focus on the use of laboratory animals in research. Animal studies play an important role in the medical research process, as they contribute to the development of drugs and treatments that can improve the quality of life for both animals and humans (EFPIA, 2022). On the other hand, the research of Akhtar (2015) indicates that the total of harms and costs to humans from sometimes unreliable animal experimentation outweigh the potential benefits of the experimentation. Research in this area shows a lively debate on the usefulness of animal experimentation, as some articles argue the important contributions of using animals, whilst others state that animal experimentation gives little useful insight (Franco, 2013; Akhtar, 2015; Kehinde, 2013).

Nowadays, research with animals is justified when there are clear benefits to the health of animals or humans and the '3Rs' are applied. The 3Rs stand in short for: replace animal experiments wherever possible with alternatives, reduce the number of animals used, and refine experiments in order to minimize the impact on animals (EFPIA, 2022). The usage of the 3Rs lead to a reduction in the overall number of animals used, a preference for non-animal methods or less sensitive animals (e.g., invertebrates), and procedures aimed at minimizing pain and distress for those animals involved in scientific research (Fenwick, 2009).

Previous research has indicated that laboratory animal professionals experience stress from their work (LaFollette et al., 2020; Rumpel et al., 2023). During their work with laboratory animals they are indirectly or directly caring and nurturing the animals which often leads to forming a bond with the animals. However, whilst taking care of these animals the laboratory animal professionals may have to view or even perform procedures that cause harm and distress to the animals, as part of their research (LaFollette et al., 2020). When a study ends, the animals that were used are often euthanized, sometimes by their own caretaker. Therefore, research that involves the usage of animals creates dilemmas for the researchers, the scientists who work with the animals, and society. The overall stress experienced by laboratory animal personnel in their workplace can be heightened by the moral stress that is caused by taking part in these processes (LaFollette et al., 2020; Engel et al., 2020). Consequently, the experienced stress can lead to impaired work performance of the employees (LeBlanc, 2009).

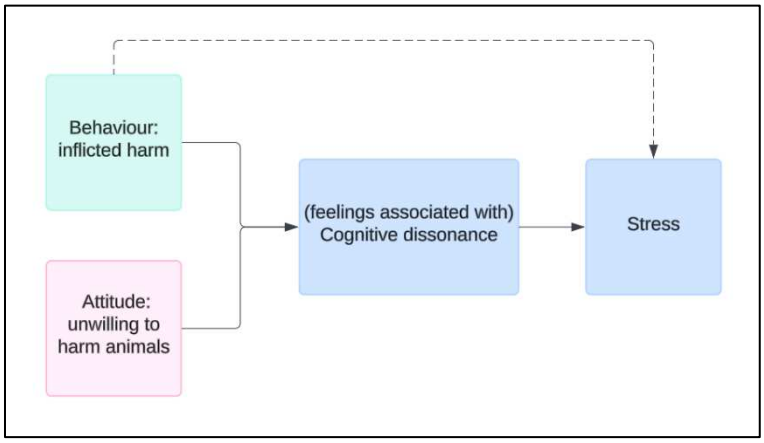
Instead of focusing on all researchers and scientists that work with laboratory animals, this paper zooms in on laboratory animal veterinarians and laboratory animal technicians. This group of laboratory animal professionals is of interest because of their possibly higher experience of stress due to moral conflict they experience. Veterinary professionals and technicians often choose veterinary medicine as their career because they have a passion for animals, care about animals, want to prevent suffering in animals, and want to soften suffering in animals (Engel et al., 2020). Taking these motivations into account, working with laboratory animals might lead to an even bigger moral conflict for veterinary-research laboratory professionals and -technicians than for human-research laboratory professionals and -technicians. This conflict is created by the primary purpose of veterinarians and caretakers which is: caring for and helping animals, and on the other hand by the requirements of research protocols. Subsequently, this can create stress for these people and their work environment (Engel et al., 2020). An often occurring phenomenon when experiencing moral conflict is ‘cognitive dissonance’. Cognitive dissonance occurs when a person is experiencing a conflict between aspects of their beliefs or thoughts and their behaviour, which causes them to experience an unpleasant affect (Colthirst-Reid, 2020; Engel et al., 2020; Mcleod, 2023). For example, when someone has the belief ‘I would never hurt animals’ and the behaviour of ‘Eating meat’ it can cause the person to experience mental discomfort. This unpleasant feeling can motivate a person to reduce the dissonance they are experiencing, which often results in altering their behaviour or attitude (Pappas, 2016; Mcleod, 2023; Rothgerber, 2020). For example, the individual can change their belief: ‘the research on animal harm in the meat

industry is not conclusive' or they can change their behaviour into 'I do not eat meat'. It can also happen that a person decides to reduce the importance of the cognitions that are causing the conflict (Pappas, 2016; Mcleod, 2023).

Previous research by Engel et al. (2020) has indicated that laboratory animal veterinarians and -technicians do experience cognitive dissonance related to their work, and accordingly, experience emotional discomfort. This research paper proposes that the cognitive dissonance in laboratory animal veterinarians and -technicians stems from the conflict between the attitude 'unwilling to harm animals', and the behaviour of 'inflicted harm on the animals'. The behaviour of 'inflicted harm' can be defined as the amount of inflicted harm performed and perceived by each individual themselves. The following model in the figure below shows the conflict between the proposed attitude and behaviour, and its potential relationship to the experienced amount cognitive dissonance and stress.

Figure 2

Potential model of cognitive dissonance & stress experienced by laboratory animal veterinarians and technicians in veterinary research



It is of interest to research the amount of cognitive dissonance and the amount of stress that these laboratory animal professionals experience for multiple reasons. Firstly, compassion fatigue, emotional-burn out, and social isolation are common mental issues that are experienced by professionals that work with laboratory animals (Engel et al., 2020; LaFollette et al., 2020). Secondly, these mental health challenges often lead to a difficulty in effectively performing tasks, and may induce a lower quality of care (LaFollette et al., 2020). These consequences can lead to a lower work performance in employees (Gibbons, 2023; LeBlanc, 2009). Thirdly, the cognitive dissonance and stress that is experienced by laboratory animal

veterinarians and -technicians has the potential to negatively impact the quality of care that is given to the laboratory animals, thereby possibly affecting their well-being. Furthermore, heightened levels of cognitive dissonance among laboratory animal professionals can serve as a clear signal, indicating the importance of enhancing the welfare standards for laboratory animals (Engel et al., 2020; LaFollette et al., 2020). Enhancing welfare standards can possibly be achieved by, for example, providing enrichment to the laboratory animals. Enrichment can be described as "any attempt to improve animal welfare by enhancing the quality of a captive animal's care by providing stimuli necessary for psychological and physical well-being" (LaFollette et al., 2020, p. 4). With more knowledge on the experienced amount of cognitive dissonance and stress in laboratory animal professionals, solutions can be designed in order to prevent mental health issues and lower work performance in personnel. In addition, these solutions can help to increase the well-being of laboratory animals.

As mentioned before, research has indicated that laboratory animal veterinarians and-technicians do experience cognitive dissonance and stress. The research of Engel et al. (2020) indicates the presence of cognitive dissonance in these professionals and goes further into possible coping mechanisms that are used by the employees. The research of LaFollette et al. (2020) gave insight into the professional quality of life, and compassion fatigue of the laboratory animal personnel. However, it is still unclear to what extent these professionals actually experience cognitive dissonance & stress. Subsequently, it is unclear whether the experienced stress in a work environment with laboratory animals is more extreme in comparison to other work environments. In addition, it is especially of interest whether laboratory animal veterinarians in veterinary research experience more cognitive dissonance in comparison to human-research laboratory animal professionals and -technicians due to a possibly intensified moral conflict.

These interests will be examined in this paper with the help of the following research question: 'To what extent do laboratory animal veterinarians and -technicians experience cognitive dissonance & stress from their work?'

Three hypotheses were constructed in order to support the research question. Firstly, it is expected that the group of laboratory animal veterinarians and -technicians in veterinary research experiences a higher degree of stress from their work than the group of human-research laboratory professionals and -technicians and the group of non-animal laboratory professionals and -technicians. This is expected due to the by research indicated stress experienced by laboratory animal personnel and the proposed conflict that could be experienced more intensely by laboratory animal veterinarians and -technicians (LaFollette et

al., 2020; Engel et al., 2020; Rumpel et al., 2023).

Secondly, it is expected that the group of laboratory animal veterinarians and -technicians in veterinary research experiences a higher degree of cognitive dissonance, due to the proposed conflicting attitude and behaviour, than the group of human-research laboratory professionals and -technicians.

Lastly, it is expected that a positive linear relationship will be found between the amount of experienced cognitive dissonance and the amount of experienced stress. This is expected due to previous research that has indicated the presence of cognitive dissonance and stress in laboratory animal personnel (LaFollette et al., 2020; Engel et al., 2020; Rumpel et al., 2023).

Methods

Participants & Design

For the purpose of this quantitative research study, three different target groups were constructed. Firstly, this research targets the group of people who identify and are described as: laboratory animal veterinarians and -technicians in veterinary research (veterinary-research group). Secondly, there is the group of people who identify and are described as: human-research laboratory professionals and -technicians (human-research group). And thirdly there is the control group of: non-animal laboratory professionals and -technicians (non-animal group). The participants in these groups had to be currently working in the described jobs in order to be able to participate.

A power analysis with 80% power, an effect size of 0.30, and an α of 0.05, was conducted and indicated that at least 37 participants should be present in each group in order to detect an effect. There was chosen for 80% power because it is the most used degree of power, and there was chosen for an effect size of 0.30 because a small to medium effect size is expected (Bhandari, 2023). It was predetermined that the gathering of the data was 9 weeks. The data collection occurred from the 10th of April until 12th of June. In total 110 people participated. However, 40 participants were excluded from the data due to incomplete responses. The final sample that was used consisted of 70 participants. The average age of the participants was 40.10 (SD = 12.14) and ranged from the age of 20 to 65. The participants resided in different countries, 46 participants were from the Netherlands, 8 from Spain, 6 from Germany, 2 from Belgium, 2 from Austria, 1 from England, 2 from the United States of

America, and 3 from ‘other’ without further indication.

The veterinary-research group consisted of 24 participants, the human-research group consisted of 18 participants, and the non-animal group consisted of 28 participants. In the veterinary-research group 5 participants identified as male, 18 participants identified as female, and 1 participant identified as other. In human-research group 8 participants identified as male, 10 participants identified as female, and 0 participants identified as other. In the non-animal group 13 participants identified as male, 14 participants identified as female, and 1 participants identified as other. The participants for this study were requited by reaching out to multiple companies, universities, LinkedIn contacts, etc.

Procedure & materials

In order to collect the data used for this research a questionnaire in the English language was constructed (see Appendix B). The questionnaire was conducted via an online environment. Every participant was firstly informed about the research and was asked to give their consent for participating in the questionnaire, to indicate that they read the information, and for agreeing to the anonymous usage of their data (see Appendix A).

The questionnaire started with demographic questions about the age, gender, country of residence, current occupation, and the work procedures that are conducted by the participants. In the veterinary-research group and human-research group the options for conducted procedures were: care taking, taking blood, treatment (vaccinating, medicine testing, etc.), observing, surgery, euthanizing, and postmortem, and ‘other’. In the non-animal group the options for conducted procedures were: cell culture assays, in vitro assays, chemical assays, and ‘other’.

Subsequently, the participants in the veterinary-research group and human-research group encountered items on attitude, behaviour, cognitive dissonance, and enrichment in the questionnaire since they work with laboratory animals. The non-animal group did not receive these items in their questionnaire as they do not work with laboratory animals and therefore are not able to respond to the statements of attitude, behaviour, cognitive dissonance, and enrichment, since these focus on working with laboratory animals.

The attitude ‘unwilling to harm animals’ was measured by four items. The statements regarding the attitude were: ‘I am unwilling to cause any form of harm to animals’, ‘I care about the physical and mental wellbeing of the research animals I work with’, ‘I feel personally responsible for the laboratory animal(s) I work with’, and ‘I feel compassion for the laboratory animal(s) I work with’. The participants were asked to indicate on a 7-point

Likert scale from ‘strongly disagree’ to ‘strongly agree’ the extent to which they experienced the attitude. These items were adjusted from the research of Engel et al. (2020) and two items were added in order to fully be able to measure the attitude.

Next, two items relating to the behaviour of inflicting harm were presented: ‘I have taken part in research procedures in in which a degree of distress and/or pain was inflicted upon the animal(s)’, ‘I have inflicted a form of harm on laboratory animal(s)’. The participants were again asked to indicate the extent to which they identified with this behaviour on a 7-point Likert scale from ‘strongly disagree’ to ‘strongly agree’. The first item was also adjusted from the research of Engel et al. (2020) and a second item was added in order to fully capture the behaviour of ‘perceived inflicted harm’.

Ensuing, four items on feelings in relation to cognitive dissonance were asked in order to measure the variable ‘cognitive dissonance’: I feel frustrated because of my work with laboratory animals’, ‘I feel uncomfortable because of my work with laboratory animals’, ‘I feel uneasy because of my work with laboratory animals’, ‘I feel bothered because of my work with laboratory animals’. On a 7-point Likert scale from ‘strongly disagree’ to ‘strongly agree’ the participants were asked to indicate to what extent they experienced the feelings related to cognitive dissonance. The items were adjusted from the research of Engel et al. (2020) and Elliot & Devine (1994).

Following, an item regarding the extent of enrichment was presented to the participants: ‘I offer enrichment to the laboratory animals’. This item regarding the variable enrichment is of interest and was put into the questionnaire due to the possible relationship it may have with the experienced amount of cognitive dissonance and therefore also may have an impact on the results of this research. Enrichment was defined to the participants above the item as: ‘any attempt to improve animal welfare by enhancing the quality of a captive animal's care by providing stimuli necessary for psychological and physical well-being’ (LaFollette et al., 2020). The participants were asked to indicate to which extent they conducted this behaviour on a 7-point Likert scale from ‘never’ to ‘always’.

Lastly, in order to measure the amount of stress the participants experience from their work, all three groups were asked to fill in the DASS-21 questionnaire which is a 21-item self-report measurement that has been designed by Lovibond et al. (1995). This questionnaire was developed in order to evaluate the extent of overall psychological distress and the manifestation of symptoms associated with depression, anxiety, and stress in adults. The DASS-21 focuses on three dimensions: depression, anxiety, and stress (Lovibond & Lovibond, 1995; Buchanan, 2024). The participants had to indicate the extent to which the

items applied to them on a 4-point Likert scale from ‘did not apply to me at all’ to ‘applied to me very much, or most of the time’ which corresponds with scoring values from 0 till 3.

Results

Descriptives

In the questionnaire the average participant in the veterinary-research group indicated to have taken part in 4.38 (*SD* = 2.30) different procedures, in the human-research group in 4.22 (*SD* = 1.41) different procedures, and in the non-animal group in 1.89 (*SD* = 3.01) different procedures (see Appendix H).

First, the scores of the DASS-21 questionnaire were calculated per participant and per category (depression, anxiety, and stress). Following, these scores were multiplied by two because the DASS-21 questionnaire is the short form of the scale. See Appendix D for the data table that gives an overview of these scores per participant per group. The DASS-21 scores could then again fall into one of the following different categories: ‘normal’, ‘mild’, ‘moderate’, ‘severe’, and ‘extremely severe’ (see Appendix C). The higher the score, the higher the amount of experienced stress, depression, and anxiety.

In the veterinary-research group, human-research group, and non-animal group the mean score for stress falls in the category ‘normal’ which ranged from 0 till 14. The mean score for depression and anxiety also falls in the category: ‘normal', which ranged for depression from 0 till 9, and for anxiety from 0 till 7. See table 1 below.

Table 1

DASS-21 mean scores of all three groups

	Stress score		Depression score		Anxiety score	
	M	*SD*	*M*	*SD*	*M*	*SD*
Group						
Veterinary-research	9.17	6.64	2.50	2.96	2.92	3.87
Human-research	10.00	8.65	5.44	6.20	5.77	9.02
Non-animal	8.50	6.22	4.79	5.03	3.00	4.06

Analyses

In order to test hypothesis 1, which states that the veterinary-research group experiences a higher degree of stress from their work than the human-research group and the non-animal group, reliability- and linear regression analyses were conducted.

The reliability analysis showed that the DASS-21 stress-scale has a good internal consistency (Cronbach's $\alpha = 0.83$). This means that the items are highly reliable in measuring the same underlying construct.

An additional reliability analysis on the other two scales showed that the depression-scale (Cronbach's $\alpha = 0.80$) and anxiety-scale (Cronbach's $\alpha = 0.87$) both have a good internal consistency as well.

The linear regression analyses were applied in order to compare the amount of experienced stress, depression, and anxiety between the three groups (see Appendix F). The linear regression analysis with the predictor groups and the dependent variable stress was found to not be statistically significant, $F(1, 68) = 0.13$, $p = 0.72$. Which means that the different groups do not explain the variability in the experienced amount of stress.

Additionally, a linear regression analysis with the predictor groups and the dependent variable depression was done. The model showed a trend, $F(1, 68) = 2.73$, $p = 0.10$. The human-research group ($M = 5.44$, $SD = 6.20$) and non-animal group ($M = 4.79$, $SD = 5.03$) scored slightly higher on depression than the veterinary-research group ($M = 2.50$, $SD = 2.96$).

Another linear regression analysis with the predictor groups and the dependent variable anxiety was done. The model was found to not be statistically significant, $F(1, 86) < 0.001$, $p = 0.99$.

In regard to hypothesis 2, which states that the veterinary-research group experiences a higher degree of cognitive dissonance, due to conflicting attitude and behaviour, than the human-research group, reliability analyses and t-tests were conducted. This was done in order to compare the means of the Likert-scale responses between the veterinary-research- and human-research group on the categories of attitude, behaviour, cognitive dissonance, and enrichment. A higher mean indicates a strong agreement with the category (e.g. a high score on attitude indicates a strong attitude of being unwilling to harm animals), with a highest possible score of '7' (see Table 4).

Table 4

Likert-scale means on attitude, behaviour, cognitive dissonance, and enrichment

	Attitude		Behaviour		Cognitive dissonance		Enrichment	
Groups	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Veterinary research	5.88	0.91	5.65	1.12	2.52	1.29	5.96	1.40
Human research	5.76	0.68	5.61	1.23	2.67	1.16	5.22	2.13

First, a reliability analysis was conducted on the different scales. As the reliability analyses showed that the attitude-scale (Cronbach's $\alpha = 0.47$) and behaviour-scale (Cronbach's $\alpha = 0.49$) both have a poor internal consistency, no further analyses were conducted with these scales.

The reliability analysis on the cognitive dissonance-scale showed that the scale has a good internal consistency (Cronbach's $\alpha = 0.86$). A t-test was conducted on the cognitive dissonance-scale in order to compare the veterinary-research group ($M = 2.52$, $SD = 1.29$) and human-research group ($M = 2.67$, $SD = 1.16$). The difference between the two groups was not statistically significant, $t(39) = -0.39$, $p = 0.70$ (see Appendix G).

A reliability analysis could not be done on the enrichment-scale as it consisted of only one item. A t-test was conducted on the enrichment-scale in order to compare the veterinary-research group ($M = 5.96$, $SD = 1.40$) and human-research group ($M = 5.22$, $SD = 2.13$). The difference between the two groups was not statistically significant, $t(28) = 1.28$, $p = 0.21$ (see Appendix G).

To answer the third hypothesis, which states that a positive relationship will be found between the amount of experienced cognitive dissonance and the amount of experienced stress, a correlation analysis was conducted. Pearson's correlation coefficient was calculated in order to indicate the strength and direction of the relationship. The analysis showed a statistically significant positive relationship, $r(40) = 0.32$, $p = 0.037$. This indicates that higher levels of cognitive dissonance are associated with higher levels of stress.

Additional analyses

Due to an interest in the possible relationship between enrichment and stress, as well as between enrichment and cognitive dissonance, another two correlation analyses were done. These two possible relationships were found to be of interest as they could provide further insight into the results and possibly explain some of the results of this study.

The first correlation analysis showed that there is no statistically significant relationship between enrichment and stress, $r(40) = -0.08$, $p = 0.60$.

The second analysis showed a statistically significant negative relationship between enrichment and cognitive dissonance, $r(40) = -0.45$, $p < 0.01$. This indicates that higher levels of enrichment are associated with lower levels of cognitive dissonance. All used codes can be found in Appendix E.

Discussion

The aim of this study was to get more insight into the experienced amount of stress and cognitive dissonance in laboratory animal professionals and -technicians. This study expected that laboratory animal veterinarians and -technicians experience more stress and cognitive dissonance from their work, due to conflicting morals, in comparison to human-research laboratory professionals and -technicians, and non-animal laboratory professionals and -technicians.

The results of this study show that the veterinary-research group, human-research group, and the non-animal group, all experience a normal amount of stress. The experienced stress levels did not differ depending on whether the participants worked with laboratory animals or whether they worked for either veterinary- or human research.

Furthermore, it was found that although there were no differences in experienced stress, higher levels of cognitive dissonance are associated with higher levels of experienced stress. Additionally, no differences were found between the human-research group and veterinary-research group in the experienced amount of cognitive dissonance. In this study, the human- and veterinary-research group did not seem to be experiencing much cognitive dissonance. This can be concluded due to the low means (M =2.52, SD = 1.29; M = 2.67, SD = 1.16) on the cognitive dissonance measurement scale which ranged from 1 till 7.

Moreover, the results of this study indicated that higher levels of enrichment are

associated with lower levels of cognitive dissonance. However, there was no relationship found between enrichment and the experienced amount of stress. This could indicate that even though enrichment reduces cognitive dissonance it does not reduce it to such an extent that stress is also decreased. These results show that the previous research from LaFollette et al. (2020) which suggested a relationship between enrichment and burn-out could be refuted. Nevertheless, these relationships are still of interest as they could propose the implementation of enrichment as a possible solution in reducing cognitive dissonance in laboratory animal professionals and -technicians. Consequently, this study contributes to a more extensive understanding of factors surrounding cognitive dissonance and its relationship with stress.

A possible explanation for the normal amount of experienced stress and low amount of experienced cognitive dissonance, could be the selection that happens when people actively choose to work with laboratory animals. Research indicated that in general laboratory animal veterinary technicians support the use of animals for research (Engel et al., 2020). These people choose a career while knowing beforehand that they may have to participate in procedures that can cause distress to the animals, suggesting that they may already feel capable of dealing with these distressing procedures (Engel et al., 2020). In addition, these people may compensate a possibly experienced mental conflict, by thinking about the necessity of using laboratory animals in order to gain knowledge and accomplish certain (veterinary) research goals (Engel et al., 2020). These findings may also apply to laboratory professionals and -technicians who use laboratory animals in order to gain more knowledge in human research.

However, it is important to keep in mind the small sample size of this study. With a larger sample size it is possible that other results are found. A relationship between enrichment and stress might become significant, and differences between groups might increase. On the other hand, a larger sample size could also further confirm that laboratory animal professionals and technicians do not experience a lot of cognitive dissonance and have normal stress levels. The small sample size of this study limits the certainty of the found results.

Regarding other possible limitations of this research, one could be the distribution of the participants across countries. In each country and even in each company professionals and technicians might deal differently with laboratory animals and might work under different circumstances. This could have had an effect on the found results. It should also be taken into account that the participants all differed in the kind of procedures they conducted with

laboratory animals. Each procedure may have induced a different effect on the variance within variables. Especially when you consider that some participants conducted euthanizing procedures on the laboratory animals while others were responsible for their care and observed them. Another limitation of this study was the unreliability of the attitude- and behaviour scale which could be explained by the inability of the items to correctly measure these constructs.

For future research it is of importance to replicate this study with more participants in order to determine whether there is a difference in experienced stress and cognitive dissonance between the veterinary-research group and the human-research group, and to see if the levels of these variables change overall. It could also be helpful in future research to account for the differences in conducted procedures by participants.

In addition, it is of interest to examine the impact of enrichment on cognitive dissonance more closely, as this can prove to be a solution in decreasing cognitive dissonance and maybe stress. Therefore enrichment could possibly help in reducing associated consequences such as burn-out and emotional fatigue. Consequently, it is useful to test this model by comparing groups who do and do not engage in enrichment.

Furthermore, the proposed model for cognitive dissonance and its surrounding factors should be tested further. There could be looked into and tested for possible causal relationships between enrichment and cognitive dissonance, as well as cognitive dissonance and stress.

Conclusion

In conclusion, this study contributes knowledge to the field of mental well-being in laboratory professionals and -technicians. By showing that cognitive dissonance has a significant positive relationship with the experienced amount of stress, and that enrichment has a significant negative relationship with the experienced amount of cognitive dissonance, possible solutions to decrease cognitive dissonance and therefore possibly stress, can be thought out. Future research should aim to replicate this study with larger sample sizes.

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Appendix

A. Informed consent statement

Dear Participant,

You are invited to participate in a research study conducted by Winde de Smit & Mariëlle Stel from the faculty of Psychology of the University of Twente. Before you decide whether or not to participate, it is important that you understand the purpose of this study and what your participation will involve. Please take a moment to read the following information carefully.

Purpose of the Study:
The purpose of this study is to examine the extent to which laboratory professionals and -technicians experience moral conflict and stress from their work.

Procedure:
On agreement to participate, you will be asked to complete the questionnaire which takes approximately 15 minutes and answer each question to your best capability. By finishing and submitting the questionnaire, a voucher of 50 euros can be won. The winner will be drawn from the total group of participants.
Your participation in this study is voluntary, and you have the right to withdraw at any time without any consequences. If you decide to terminate your participation in this research, all your data will be fully deleted and omitted from the research results.

Confidentiality:
Your data will be handled with utmost confidentiality. The collected data will be stored securely. Your individual responses cannot be traced back to you, neither can the data be traced back to the company you work for. Research results are solely reported in groups of gathered data across multiple companies.

Risks and Benefits:

While participating people may experience feelings of discomfort, however this will be no more than the discomfort they are already experiencing as the current amount of discomfort is measured. There are no other foreseeable risks associated with participating in this study. In addition, your participation will contribute to knowledge regarding experienced moral conflict and stress in different work areas, which provides valuable insights for both academics as well as practitioners. A direct benefit from the study is the possibility of winning of the 50 euros voucher.

Questions or Concerns:
If you have any questions about the study or your participation, please feel free to contact Winde de Smit (w.p.r.w.desmit@student.utwente.nl) or Mariëlle Stel (m.stel@utwente.nl). If you have concerns about your rights as a participant, you may contact The BMS Ethics (ethicscommittee-hss@utwente.nl).

Consent:
By continuing with this questionnaire and answering the following question with your consent, you indicate that you have read the information provided above, that your questions have been answered to your satisfaction, and that you voluntarily consent to participate in this research study.

Hereby, I declare that I

- give my consent and agree to partake in this study
- do not consent

Thank you for considering your participation in this study.
Sincerely,

Winde de Smit

B. The questionnaires

Working with laboratory animals in veterinary research

Start of Block: Information

Q42 Dear participant,

Thank you for your willingness to participate in this questionnaire.
Please keep in mind that this questionnaire is meant for people who are currently working as a laboratory animal veterinarians or -technicians in veterinary research.

If you are not currently working in the mentioned group please do not participate in the questionnaire.

Thank you for your time.

End of Block: Information

Start of Block: Informed Consent Statement

Q1 Dear Participant,

You are invited to participate in a research study conducted by Winde de Smit & Mariëlle Stel from the faculty of Psychology of the University of Twente. Before you decide whether or not to participate, it is important that you understand the purpose of this study and what your participation

will involve. Please take a moment to read the following information carefully.

Purpose of the Study:
The purpose of this study is to examine the extent to which laboratory professionals and -technicians experience moral conflict and stress from their work.

Procedure:
On agreement to participate, you will be asked to complete the questionnaire which takes approximately 10 minutes and answer each question to your best capability. By finishing and submitting the questionnaire, a voucher of 50 euros can be won. The winner will be drawn from the total group of participants.
Your participation in this study is voluntary, and you have the right to withdraw at any time without any consequences. If you decide to terminate your participation in this research, all your data will be fully deleted and omitted from the research results.

Confidentiality:
Your data will be handled with utmost confidentiality. The collected data will be stored securely. Your individual responses cannot be traced back to you, neither can the data be traced back to the company you work for. Research results are solely reported in groups of gathered data across multiple companies.

Risks and Benefits:
While participating people may experience feelings of discomfort, however this will be no more than the discomfort they are already experiencing as the current amount of discomfort is measured. There are no other foreseeable risks associated with participating in this study. In addition, your participation will contribute to knowledge regarding experienced moral conflict and stress in different work areas, which provides valuable insights for both academics as well as practitioners. A direct benefit from the study is the possibility of winning of the 50 euros voucher.

Questions or Concerns:
If you have any questions about the study or your participation, please feel free to contact Winde de Smit (w.p.r.w.desmit@student.utwente.nl) or Mariëlle Stel (m.stel@utwente.nl). If you have concerns about your rights as a participant, you may contact The BMS Ethics (ethicscommittee-hss@utwente.nl).

Consent: By continuing with this questionnaire and answering the following question with your consent, you indicate that you have read the information provided above, that your questions have been answered to your satisfaction, and that you voluntarily consent to participate in this research study.

Thank you for considering your participation in this study.
Sincerely,

Winde de Smit & Mariëlle Stel

- ○ Hereby, I declare that I give my consent and agree to partake in this study (1)
- ○ Hereby, I declare that I do not consent (2)

End of Block: Informed Consent Statement

Start of Block: Demographics

Q45 Following, a few questions regarding demographics will be asked.

Q2 What is your age?

_____

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Q4 What is your country of residence?

- ○ The Netherlands (4)
- ○ Germany (5)
- ○ Spain (6)
- ○ Belgium (8)
- ○ France (10)
- ○ England (11)
- ○ The United States of America (7)
- ○ Other (9) _____

Q5 What is your current occupation?

- ○ Animal laboratory veterinarian (1)
- ○ Animal laboratory veterinary technician (2)
- ○ Other (3) _____

Q6 Which procedures do you conduct on the laboratory animal(s)?

Multiple answers can be selected.

- ☐ Care taking (1)
- ☐ Taking blood (2)
- ☐ Treatment (vaccinating, medicine testing, etc.) (3)
- ☐ Observing (4)
- ☐ Surgery (5)
- ☐ Euthanizing (6)
- ☐ Post Mortem (7)
- ☐ Other (8) _____

End of Block: Demographics

Start of Block: Attitude related items

Q46 Next, you will be shown four statements regarding your feelings towards working with laboratory animals. Please indicate the extent to which you agree with the statements in your personal experience.

Q7 I am unwilling to cause any form of harm to animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q8 I care about the physical and mental wellbeing of the research animals I work with.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q9 I feel personally responsible for the laboratory animal(s) I work with.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q10 I feel compassion for the laboratory animal(s) I work with.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Attitude related items

Start of Block: Behaviour related items

Q47 Next, two statements will be shown regarding your behaviour in working with laboratory animals. Please indicate the extent to which you agree with the statements in your personal experience.

Q12 I have taken part in research procedures in which a degree of distress and/or pain was inflicted upon the animal(s).

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q13 I have inflicted a form of harm on laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Behaviour related items

Start of Block: Cognitive dissonance related items

Q49 Next, four statements are shown regarding your feelings that are related to the experience of cognitive dissonance (moral stress). Please indicate the extent to which you agree with the statements in your personal experience.

Q14 I feel frustrated working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q15 I feel uncomfortable working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q16 I feel uneasy working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q17 I feel bothered working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Cognitive dissonance related items

Start of Block: Enrichment item

Q50 Next, you are shown a statement regarding enrichment for laboratory animals. Please indicate the extent to which you agree with the statement in your personal experience.

Enrichment is defined as: "any attempt to improve animal welfare by enhancing the quality of a captive animal's care by providing stimuli necessary for psychological and physical well-being".

Q39 I offer enrichment to the laboratory animals.

- ○ Never (1)
- ○ Rarely (2)
- ○ Occasionally (3)
- ○ Sometimes (4)
- ○ Frequently (5)
- ○ Usually (6)
- ○ Always (7)

End of Block: Enrichment item

Start of Block: DASS-21

Q51 Next, you are asked to fill in a questionnaire regarding the amount of stress experienced in the workplace. Please indicate to what extent the following statements applied to you over the past week.

Q18 I found it hard to wind down.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q19 I was aware of dryness in my mouth.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q20 I couldn't seem to experience any positive feeling at all.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q21 I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion).

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q22 I found it difficult to work up the initiative to do things.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q23 I tended to over-react to situations.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q24 I experienced trembling (e.g. in the hands).

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q25 I felt that I was using a lot of nervous energy

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q26 I was worried about situations in which I might panic and make a fool of myself.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q27 I felt that I had nothing to look forward to.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q28 I found myself getting agitated.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q29 I found it difficult to relax.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q30 I felt down-hearted and blue.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q31 I was intolerant of anything that kept me from getting on with what I was doing.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q32 I felt I was close to panic.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q33 I was unable to become enthusiastic about anything.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q34 I felt I wasn't worth much as a person.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q35 I felt I was rather touchy.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q36 I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat).

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q37 I felt scared without any good reason.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q38 I felt that life was meaningless.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

End of Block: DASS-21

Start of Block: Block 8

Q52

Thank you for your time and for participating in this questionnaire.

If you have any questions left, feel free to contact us via the following email adresses: w.p.r.w.desmit@student.utwente.nl or m.stel@utwente.nl

If you wish to participate in winning the 50 euros voucher or if you wish to receive the final report upon completion of the research, please click the following link:

https://utwentebs.eu.qualtrics.com/jfe/form/SV_5aNstKZVxhK9YKq

Thank you and you are now done with the questionnaire.

End of Block: Block 8

Working with laboratory animals in human research

Start of Block: Information

Q42 Dear participant,

Thank you for your willingness to participate in this questionnaire.
Please keep in mind that this questionnaire is meant for people who are currently working as human-research laboratory professionals and -technicians.

If you are not currently working in the mentioned group please do not participate in the questionnaire.

Thank you for your time.

End of Block: Information

Start of Block: Informed Consent Statement

Q1 Dear Participant,

You are invited to participate in a research study conducted by Winde de Smit & Mariëlle Stel from the faculty of Psychology of the University of Twente. Before you decide whether or not to participate, it is important that you understand the purpose of this study and what your participation will involve. Please take a moment to read the following information carefully.

Purpose of the Study:
The purpose of this study is to examine the extent to which laboratory professionals and -technicians experience moral conflict and stress from their work.

Procedure:
On agreement to participate, you will be asked to complete the questionnaire which takes approximately 10 minutes and answer each question to your best capability. By finishing and submitting the questionnaire, a voucher of 50 euros can be won. The winner will be drawn from the total group of participants.
Your participation in this study is voluntary, and you have the right to withdraw at any time without any consequences. If you decide to terminate your participation in this research, all your data will be fully deleted and omitted from the research results.

Confidentiality:
Your data will be handled with utmost confidentiality. The collected data will be stored securely. Your individual responses cannot be traced back to you, neither can the data be traced back to the company you work for. Research results are solely reported in groups of gathered data across multiple companies.

Risks and Benefits:
While participating people may experience feelings of discomfort, however this will be no more than the discomfort they are already experiencing as the current amount of discomfort is measured. There are no other foreseeable risks associated with participating in this study. In addition, your participation will contribute to knowledge regarding experienced moral conflict and stress in different work areas, which provides valuable insights for both academics as well as practitioners. A direct benefit from the study is the possibility of winning of the 50 euros voucher.

Questions or Concerns:
If you have any questions about the study or your participation, please feel free to contact Winde de Smit (w.p.r.w.desmit@student.utwente.nl) or Mariëlle Stel (m.stel@utwente.nl). If you have concerns about your rights as a participant, you may contact The BMS Ethics (ethicscommittee-hss@utwente.nl).

Consent: By continuing with this questionnaire and answering the following question with your

consent, you indicate that you have read the information provided above, that your questions have been answered to your satisfaction, and that you voluntarily consent to participate in this research study.

Thank you for considering your participation in this study.
Sincerely,

Winde de Smit & Mariëlle Stel

- ○ Hereby, I declare that I give my consent and agree to partake in this study (1)
- ○ Hereby, I declare that I do not consent (2)

End of Block: Informed Consent Statement

Start of Block: Demographics

Q45 Following, a few questions regarding demographics will be asked.

Q2 What is your age?

_____

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Q4 What is your country of residence?

- ○ The Netherlands (4)
- ○ Germany (5)
- ○ Spain (6)
- ○ Belgium (8)
- ○ France (10)
- ○ England (11)
- ○ The United States of America (7)
- ○ Other (9) _____

Q5 What is your current occupation?

- ○ Animal laboratory professional (1)
- ○ Animal laboratory technician (2)
- ○ Other (3) _____

Q6 Which procedures do you conduct on the laboratory animal(s)?

Multiple answers can be selected.

- ☐ Care taking (1)
- ☐ Taking blood (2)
- ☐ Treatment (vaccinating, medicine testing, etc.) (3)
- ☐ Observing (4)
- ☐ Surgery (5)
- ☐ Euthanizing (6)
- ☐ Post Mortem (7)
- ☐ Other (8) _____

End of Block: Demographics

Start of Block: Attitude related items

Q46 Next, you will be shown four statements regarding your feelings towards working with laboratory animals. Please indicate the extent to which you agree with the statements in your personal experience.

Q7 I am unwilling to cause any form of harm to animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q8 I care about the physical and mental wellbeing of the research animals I work with.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q9 I feel personally responsible for the laboratory animal(s) I work with.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q10 I feel compassion for the laboratory animal(s) I work with.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Attitude related items

Start of Block: Behaviour related items

Q47 Next, two statements will be shown regarding your behaviour in working with laboratory animals. Please indicate the extent to which you agree with the statements in your personal experience.

Q12 I have taken part in research procedures in which a degree of distress and/or pain was inflicted upon the animal(s).

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q13 I have inflicted a form of harm on laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Behaviour related items

Start of Block: Cognitive dissonance related items

Q49 Next, four statements are shown regarding your feelings that are related to the experience of cognitive dissonance (moral stress). Please indicate the extent to which you agree with the statements in your personal experience.

Q14 I feel frustrated working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q15 I feel uncomfortable working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q16 I feel uneasy working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

Q17 I feel bothered working with laboratory animals.

- ○ Strongly disagree (1)
- ○ Disagree (2)
- ○ Slightly disagree (3)
- ○ Neutral (4)
- ○ Slightly agree (5)
- ○ Agree (6)
- ○ Strongly agree (7)

End of Block: Cognitive dissonance related items

Start of Block: Enrichment item

Q50 Next, you are shown a statement regarding enrichment for laboratory animals. Please indicate the extent to which you agree with the statement in your personal experience.

Enrichment is defined as: "any attempt to improve animal welfare by enhancing the quality of a captive animal's care by providing stimuli necessary for psychological and physical well-being".

Q39 I offer enrichment to the laboratory animals.

- ○ Never (1)
- ○ Rarely (2)
- ○ Occasionally (3)
- ○ Sometimes (4)
- ○ Frequently (5)
- ○ Usually (6)
- ○ Always (7)

End of Block: Enrichment item

Start of Block: DASS-21

Q51 Next, you are asked to fill in a questionnaire regarding the amount of stress experienced in the workplace. Please indicate to what extent the following statements applied to you over the past week.

Q18 I found it hard to wind down.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q19 I was aware of dryness in my mouth.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q20 I couldn't seem to experience any positive feeling at all.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q21 I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion).

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q22 I found it difficult to work up the initiative to do things.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q23 I tended to over-react to situations.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q24 I experienced trembling (e.g. in the hands).

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q25 I felt that I was using a lot of nervous energy

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q26 I was worried about situations in which I might panic and make a fool of myself.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q27 I felt that I had nothing to look forward to.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q28 I found myself getting agitated.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q29 I found it difficult to relax.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q30 I felt down-hearted and blue.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q31 I was intolerant of anything that kept me from getting on with what I was doing.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q32 I felt I was close to panic.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q33 I was unable to become enthusiastic about anything.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q34 I felt I wasn't worth much as a person.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q35 I felt I was rather touchy.

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
- Applied to me very much, or most of the time (4)

Q36 I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat).

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q37 I felt scared without any good reason.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q38 I felt that life was meaningless.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

End of Block: DASS-21

Start of Block: Block 8

Q52

Thank you for your time and for participating in this questionnaire.

If you have any questions left, feel free to contact us via the following email adresses: w.p.r.w.desmit@student.utwente.nl or m.stel@utwente.nl

If you wish to participate in winning the 50 euros voucher or if you wish to receive the final report upon completion of the research, please click the following link:

https://utwentebs.eu.qualtrics.com/jfe/form/SV_5aNstKZVxhK9YKq

Thank you and you are now done with the questionnaire.

End of Block: Block 8

Laboratoria without animals

Start of Block: Information

Q42 Dear participant,

Thank you for your willingness to participate in this questionnaire.
Please keep in mind that this questionnaire is meant for people who are currently working as laboratory professionals and technicians that do not work with laboratory animals.

If you are not currently working in the mentioned group please do not participate in the questionnaire.

Thank you for your time.

End of Block: Information

Start of Block: Informed Consent Statement

Q1 Dear Participant,

You are invited to participate in a research study conducted by Winde de Smit & Mariëlle Stel from the faculty of Psychology of the University of Twente. Before you decide whether or not to participate, it is important that you understand the purpose of this study and what your participation will involve. Please take a moment to read the following information carefully.

Purpose of the Study:
The purpose of this study is to examine the extent to which laboratory professionals and -technicians

experience stress from their work.

Procedure:
On agreement to participate, you will be asked to complete the questionnaire which takes approximately 5 minutes and answer each question to your best capability. By finishing and submitting the questionnaire, a voucher of 50 euros can be won. The winner will be drawn from the total group of participants.
Your participation in this study is voluntary, and you have the right to withdraw at any time without any consequences. If you decide to terminate your participation in this research, all your data will be fully deleted and omitted from the research results.

Confidentiality:
Your data will be handled with utmost confidentiality. The collected data will be stored securely. Your individual responses cannot be traced back to you, neither can the data be traced back to the company you work for. Research results are solely reported in groups of gathered data across multiple companies.

Risks and Benefits:
While participating people may experience feelings of discomfort, however this will be no more than the discomfort they are already experiencing as the current amount of discomfort is measured. There are no other foreseeable risks associated with participating in this study. In addition, your participation will contribute to knowledge regarding experienced stress in different work areas, which provides valuable insights for both academics as well as practitioners. A direct benefit from the study is the possibility of winning of the 50 euros voucher.

Questions or Concerns:
If you have any questions about the study or your participation, please feel free to contact Winde de Smit (w.p.r.w.desmit@student.utwente.nl) or Mariëlle Stel (m.stel@utwente.nl). If you have concerns about your rights as a participant, you may contact The BMS Ethics (ethicscommittee-hss@utwente.nl).

Consent: By continuing with this questionnaire and answering the following question with your consent, you indicate that you have read the information provided above, that your questions have been answered to your satisfaction, and that you voluntarily consent to participate in this research study.

Thank you for considering your participation in this study.

Sincerely,

Winde de Smit & Mariëlle Stel

- ○ Hereby, I declare that I give my consent and agree to partake in this study (1)
- ○ Hereby, I declare that I do not consent (2)

End of Block: Informed Consent Statement

Start of Block: Demographics

Q45 Following, a few questions regarding demographics will be asked.

Q2 What is your age?

_____

Q3 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / third gender (3)
- ○ Prefer not to say (4)

Q4 What is your country of residence?

- ○ The Netherlands (4)
- ○ Germany (5)
- ○ Spain (6)
- ○ Belgium (8)
- ○ France (10)
- ○ England (11)
- ○ The United States of America (7)
- ○ Other (9) _____

Q5 What is your current occupation?

- ○ Laboratory professional (1)
- ○ Laboratory technician (2)
- ○ Other (3) _____

Q39 What procedures do you conduct in the laboratorium?

- ☐ Cell culture assays (2)
- ☐ In vitro assays (e.g. ELISA'S, PCR'S) (3)
- ☐ Chemical assays (4)
- ☐ Other (8) _____

End of Block: Demographics

Start of Block: DASS-21

Q51 Next, you are asked to fill in a questionnaire regarding the amount of stress experienced in the workplace. Please indicate to what extent the following statements applied to you over the past week.

Q18 I found it hard to wind down.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q19 I was aware of dryness in my mouth.

- ○ Did not apply to me at all (1)
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- ○ Did not apply to me at all (1)
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- Applied to me to a considerable degree, or a good part of the time (3)
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Q35 I felt I was rather touchy.

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- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

Q36 I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat).

- Did not apply to me at all (1)
- Applied to me to some degree, or some of the time (2)
- Applied to me to a considerable degree, or a good part of the time (3)
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- Applied to me to a considerable degree, or a good part of the time (3)
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Q38 I felt that life was meaningless.

- ○ Did not apply to me at all (1)
- ○ Applied to me to some degree, or some of the time (2)
- ○ Applied to me to a considerable degree, or a good part of the time (3)
- ○ Applied to me very much, or most of the time (4)

End of Block: DASS-21

Start of Block: Block 4

Q52

Thank you for your time and for participating in this questionnaire.

If you have any questions left, feel free to contact us via the following email adresses: w.p.r.w.desmit@student.utwente.nl or m.stel@utwente.nl

If you wish to participate in winning the 50 euros voucher or if you wish to receive the final report upon completion of the research, please click the following link:

https://utwentebs.eu.qualtrics.com/jfe/form/SV_5aNstKZVxhK9YKq

Thank you and you are now done with the questionnaire.

End of Block: Block 4

C. Scoring form, DASS-21

Based on Buchanan (2024) and Lovibond and Lovibond (1995)

Each of the three DASS-21 scales contains 7 items:

Depression (Items 3, 5, 10, 13, 16, 17, 21)

Symptoms such as dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia, and inertia.

Anxiety (Items 2, 4, 7, 9, 15, 19, 20)

Symptoms such as physiological arousal and fear components of anxiety. It assesses autonomic arousal typical of anxiety, such as trembling, sweating, feelings of panic, and the fear of losing control. The anxiety items are intended to measure the respondent's experience of anxious arousal, and are not focussed on the worry typical of Generalised Anxiety Disorder.

Stress (Items 1, 6, 8, 11, 12, 14, 18)

Chronic symptoms of non-specific arousal. It assesses difficulty relaxing, nervous arousal, and being easily upset/agitated, irritable/over-reactive, and impatient. Stress items are focused on the respondent's state of tension and chronic general arousal, capturing how much the respondent feels overburdened or overwhelmed by life's stressors.

Scores on the DASS-21 will need to be multiplied by 2 to calculate the final score.

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

D. DASS-21 Score table

Participants	Groups	TotalSum	TotalSumDep	TotalSumAnx	TotalSumStr
1	0	4	0	0	4
2	0	46	10	12	24
3	0	6	2	0	4
4	0	8	0	2	6
5	0	30	4	8	18
6	0	16	2	0	14
7	0	0	0	0	0
8	0	20	6	2	12
9	0	6	0	0	6
10	0	34	2	10	22
11	0	14	4	2	8
12	0	18	2	4	12
13	0	12	0	4	8
14	0	36	8	12	16
15	0	2	0	2	0
16	0	2	0	0	2
17	0	14	0	4	10
18	0	6	0	0	6
19	0	20	4	0	16

20	0	18	6	0	12
21	0	18	4	4	10
22	0	4	0	0	4
23	0	14	6	4	4
24	0	2	0	0	2
25	1	0	0	0	0
26	1	40	14	4	22
27	1	74	12	36	26
28	1	52	16	16	20
29	1	12	2	2	8
30	1	20	2	8	10
31	1	52	18	12	22
32	1	4	2	0	2
33	1	2	0	2	0
34	1	44	12	12	20
35	1	22	6	4	12
36	1	10	2	0	8
37	1	22	8	2	12
38	1	6	0	0	6
39	1	2	0	0	2
40	1	4	2	0	2
41	1	16	2	6	8

42	1	0	0	0	0
43	2	36	6	14	16
44	2	20	10	4	6
45	2	2	0	0	2
46	2	8	2	0	6
47	2	6	2	0	4
48	2	12	0	2	10
49	2	0	0	0	0
50	2	14	4	6	4
51	2	14	4	0	10
52	2	2	0	0	2
53	2	12	4	0	8
54	2	18	6	2	10
55	2	24	6	8	10
56	2	2	2	0	0
57	2	2	2	0	0
58	2	14	2	0	12
59	2	20	4	0	16
60	2	18	6	0	12
61	2	0	0	0	0
62	2	16	2	0	14
63	2	32	14	2	16

64	2	8	4	2	2
65	2	40	20	10	10
66	2	26	2	8	16
67	2	44	12	8	24
68	2	36	14	10	12
69	2	24	6	6	12
70	2	6	0	2	4

E. R-code

```
install.packages("pwr")

library(pwr)

# Define parameters

num_groups <- 3      # Number of groups

effect_size <- 0.30  # Effect size (partial eta-squared)


alpha <- 0.05        # Significance level

power <- 0.80        # Desired power

# Perform power analysis for ANOVA

pwr.anova.test(k = num_groups, f = effect_size, sig.level = alpha, power = power)


install.packages("readxl")

install.packages("readxl")

install.packages("ggplot2")

install.packages("officer")

install.packages("dplyr")

install.packages("flextable")

install.packages("tibble")

install.packages("psych")

library(dplyr)

library("ggplot2")

library(readxl)

library(flextable)
```

```
library(officer)

library(tibble)

library(psych)

#------------------------------------------------------------------------

# Load data from CSV

setwd("C:/Users/wolf-/Documents")

Mergeddata <- read_excel("Thesisdatamerged.xlsx")

#remove columns

Mergeddata2 <- Mergeddata %>% select(-StartDate, -EndDate, -Status, -IPAddress, -Progress, -`Duration (in seconds)`, -Finished, -RecordedDate, -ResponseId, -RecipientLastName, -RecipientFirstName, -RecipientEmail, -ExternalReference, -LocationLatitude, -LocationLongitude, -DistributionChannel, -UserLanguage)

#remove rows

rows_to_delete <- c(1,13,18)

Mergeddata2 <- Mergeddata2[-rows_to_delete, ]

age <- mean(Mergeddata2$Q2)

summary(Mergeddata2$Q2)

Mergeddata2$Q2 <- as.numeric(Mergeddata2$Q2)

print(age)

sd <- sd(Mergeddata2$Q2, na.rm = TRUE)

print(sd)


Mergedstress <- Mergeddata2[, c("Groups", "Q18", "Q19", "Q20", "Q21", "Q22", "Q23", "Q24", "Q25", "Q26", "Q27", "Q28", "Q29", "Q30", "Q31", "Q32", "Q33", "Q34", "Q35", "Q36", "Q37", "Q38")]
```

```
#numerical values

replacement <- c("Did not apply to me at all" = 0,

                 "Applied to me to some degree, or some of the time" = 1,

                 "Applied to me a considerable degree, or a good part of the time" = 2,

                 "Applied to me to a considerable degree, or a good part of the time" = 2,

                 "Applied to me a to considerable degree, or a good part of the time" = 2,

                 "Applied to me very much, or most of the time" = 3)


Mergedstress <- data.frame(lapply(Mergedstress, function(x) replacement[x]))

total_columns <- c("Q18", "Q19", "Q20", "Q21", "Q22", "Q23", "Q24", "Q25", "Q26",
"Q27", "Q28", "Q29", "Q30", "Q31", "Q32", "Q33", "Q34", "Q35", "Q36", "Q37", "Q38")

Mergedstress$TotalSum <- rowSums(Mergedstress[,total_columns])


depression_columns <- c("Q20", "Q22", "Q27", "Q30", "Q33", "Q34", "Q38")

depression_data <- Mergedstress[, depression_columns]

cronbach_alpha <- alpha(depression_data)

print(cronbach_alpha)


anxiety_columns <- c("Q19", "Q21", "Q24", "Q26", "Q32", "Q36", "Q37")

anxiety_data <- Mergedstress[, anxiety_columns]

cronbach_alpha<- alpha(anxiety_data)

print(cronbach_alpha)


stress_columns <- c("Q18", "Q23", "Q25", "Q28", "Q29", "Q31", "Q35")

stress_data <- Mergedstress [, stress_columns]
```

```
cronbach_alpha <- alpha(stress_data)

print(cronbach_alpha)


Mergedstress$TotalSumDep <- rowSums(Mergedstress[, depression_columns])

Mergedstress$TotalSumAnx <- rowSums(Mergedstress[, anxiety_columns])

Mergedstress$TotalSumStr <- rowSums(Mergedstress[, stress_columns])


Mergedstress$TotalSum <- Mergedstress$TotalSum * 2

Mergedstress$TotalSumDep <- Mergedstress$TotalSumDep * 2

Mergedstress$TotalSumAnx <- Mergedstress$TotalSumAnx * 2

Mergedstress$TotalSumStr <- Mergedstress$TotalSumStr * 2


#Create table with totals

selected_columns <- c("Groups", "TotalSum", "TotalSumDep", "TotalSumAnx",
"TotalSumStr")

Stresstable <- Mergedstress[, selected_columns]


ft <- flextable(Stresstable)

doc <- read_docx()

doc <- body_add_flextable(doc, value = ft)

print(doc, target = "data_table.docx")


group_means <- Stresstable %>%

  group_by(Groups) %>%

  summarise(
```

```
    MeanTotalSum = mean(TotalSum),
    SdTotalSum = sd (TotalSum),
    MeanTotalSumDep = mean(TotalSumDep),
    SdTotalSumDep = sd(TotalSumDep),
    MeanTotalSumAnx = mean(TotalSumAnx),
    SdTotalSumAnx = sd(TotalSumAnx),
    MeanTotalSumStr = mean(TotalSumStr),
    SdTotalSumStr = sd(TotalSumStr))
print(group_means)
view(group_means)
#linear models
modelstress <- lm(TotalSumStr ~ Groups, data = Stresstable)
summary(modelstress)

modeldep <- lm(TotalSumDep ~ Groups, data = Stresstable)
summary(modeldep)

modelanx <- lm(TotalSumAnx ~ Groups, data = Stresstable)
summary(modelanx)

modelall <- lm(TotalSumStr ~ TotalSumAnx + TotalSumDep + as.factor(Groups), data =
Stresstable)
summary(modelall)

#Likert scales
```

```
Attitude <- Mergeddata2[, c("Groups","Q7", "Q8", "Q9", "Q10")]

replacementattitude <- c("Strongly disagree" = 1, "Disagree" = 2, "Slightly disagree" = 3, "Neutral" = 4, "Slightly agree" = 5, "Agree" = 6, "Strongly agree" = 7)

Attitude <- data.frame(lapply(Attitude, function(x) replacementattitude[x]))

#delete groups for cronbach alpha

cronbach_alpha <- alpha(Attitude)

print(cronbach_alpha)


Attitude$RowSum <- rowSums(Attitude[, c("Q7", "Q8", "Q9", "Q10")])

Attitude$RowAvg <- Attitude$RowSum / length(c( "Q7", "Q8", "Q9", "Q10"))

Attitude <- Attitude[-c(43:70),]


groupattitude <- Attitude %>%

  group_by(Groups) %>%

  summarise(

    Avg = mean(RowAvg),

    SD = sd(RowAvg))


print(groupattitude)


Behaviour <- Mergeddata2[, c("Groups","Q12", "Q13")]

replacementbehaviour <- c("Strongly disagree" = 1, "Disagree" = 2, "Slightly disagree" = 3, "Neutral" = 4, "Slightly agree" = 5, "Agree" = 6, "Strongly agree" = 7)

Behaviour <- data.frame(lapply(Behaviour, function(x) replacementbehaviour[x]))

Behaviour <- Behaviour[-c(43:70),]
```

```
Behaviour$RowSum <- rowSums(Behaviour[, c("Q12", "Q13")])

Behaviour$RowAvg <- Behaviour$RowSum / length(c("Q12", "Q13"))

#delete groups for cronbach alpha

cronbach_alpha <- alpha(Behaviour)

print(cronbach_alpha)

groupbehaviour <- Behaviour %>%

  group_by(Groups) %>%

  summarise(

    Avg = mean(RowAvg),

    SD = sd(RowAvg))


print(groupbehaviour)


Cogdis <- Mergeddata2[, c("Groups","Q14", "Q15", "Q16", "Q17")]

replacementcogdis <- c("Strongly disagree" = 1, "Disagree" = 2, "Slightly disagree" = 3,
"Neutral" = 4, "Slightly agree" = 5, "Agree" = 6, "Strongly agree" = 7)

Cogdis <- data.frame(lapply(Cogdis, function(x) replacementcogdis[x]))

Cogdis <- Cogdis[-c(43:70),]

Cogdis$RowSum <- rowSums(Cogdis[, c("Q14", "Q15", "Q16", "Q17")])

Cogdis$RowAvg <- Cogdis$RowSum / length(c("Q14", "Q15", "Q16", "Q17"))

#delete groups for cronbach alpha

cronbach_alpha <- alpha(Cogdis)

print(cronbach_alpha)


groupcogdis <- Cogdis %>%
```

```
  group_by(Groups) %>%
  summarise(
    Avg = mean(RowAvg),
    SD = sd(RowAvg))

print(groupcogdis)

Enrichment <- Mergeddata2[, c("Groups", "Q39")]
replacementenrichment <- c("Never" = 1, "Rarely" = 2, "Occasionally" = 3, "Sometimes" = 4, "Frequently" = 5, "Usually" = 6, "Always" = 7)
Enrichment <- data.frame(lapply(Enrichment, function(x) replacementenrichment[x]))
Enrichment <- Enrichment[-c(43:70),]
Enrichment$RowAvg <- Enrichment$Q39 / length(c("Q39"))

groupenrichment <- Enrichment %>%
  group_by(Groups) %>%
  summarise(
    Avg = mean(RowAvg),
    SD = sd(RowAvg))

print(groupenrichment)

#t-tests

ttestattitude <- t.test(RowAvg ~ Groups, data = Attitude)
```

```
print(ttestattitude)


ttestbehaviour <- t.test(RowAvg ~ Groups, data = Behaviour)

print(ttestbehaviour)


ttestcogdis <- t.test(RowAvg ~ Groups, data = Cogdis)

print(ttestcogdis)


ttestenrichment <- t.test(RowAvg ~ Groups, data = Enrichment)

print(ttestenrichment)


#multiple linear regression models

combineddata <- cbind(Attitude$RowAvg, Behaviour$RowAvg, Cogdis$RowAvg)

combineddata <- data.frame(Avgattitude = Attitude$RowAvg,

                           Avgbehaviour = Behaviour$RowAvg,

                           Avgcogdis  = Cogdis$RowAvg)

model <- lm(Avgcogdis ~ Avgattitude + Avgbehaviour, data = combineddata)

summary(model)


Depression_M <- c(2.5, 5.4)

Anxiety_M <- c(2.9, 5.8)

Stress_M <- c(9.2, 10.0)

Enrichment_M <- c(6.0, 5.2)

df <- data.frame(Depression_M, Depression_SD, Anxiety_M, Anxiety_SD, Stress_M,
Enrichment_M)
```

```
lm(formula = cbind(Depression_M, Anxiety_M, Stress_M) ~ Enrichment_M, data = df)


#correlation


stress <- Mergedstress$TotalSumStr

stress <- stress[-c(43:70)]

correlation <- cor.test(Cogdis$RowAvg, stress, method = "pearson")

print(correlation)

correlation2 <- cor.test(Cogdis$RowAvg, Enrichment$Q39, method = "pearson")

print(correlation2)


#Amount of procedures on average

# Given data

procedures <- c(20, 22, 6, 5)


# Total number of participants

num_participants <- 28


# Calculate the mean number of procedures per participant

mean_procedures_per_participant <- sum(procedures) / num_participants


# Standard deviation calculation

variance <- sum((procedures - mean_procedures_per_participant)^2) / (length(procedures) -
1)
```

```
standard_deviation <- sqrt(variance / num_participants)

# Print the mean and standard deviation
cat("Mean procedures per participant:", mean_procedures_per_participant, "\n")
cat("Standard deviation:", standard_deviation, "\n")

procedures1 <- c (7, 9, 9, 13, 8, 12, 9, 9)

# Total number of participants
num_participants1 <- 18

# Calculate the mean number of procedures per participant
mean_procedures_per_participant1 <- sum(procedures1) / num_participants1

# Standard deviation calculation
variance1 <- sum((procedures1 - mean_procedures_per_participant1)^2) /
(length(procedures1) - 1)
standard_deviation1 <- sqrt(variance1 / num_participants1)

# Print the mean and standard deviation
cat("Mean procedures per participant:", mean_procedures_per_participant1, "\n")
cat("Standard deviation:", standard_deviation1, "\n")

procedures2 <- c (11, 15, 18, 23, 3, 16, 12, 7)
```

```
# Total number of participants
num_participants2 <- 24

# Calculate the mean number of procedures per participant
mean_procedures_per_participant2 <- sum(procedures2) / num_participants2

# Standard deviation calculation
variance2 <- sum((procedures2 - mean_procedures_per_participant2)^2) /
(length(procedures2) - 1)
standard_deviation2 <- sqrt(variance2 / num_participants2)

# Print the mean and standard deviation
cat("Mean procedures per participant:", mean_procedures_per_participant2, "\n")
cat("Standard deviation:", standard_deviation2, "\n")
```

F. Linear regression models for stress, depression and anxiety.

Depression:

```
Call:
lm(formula = TotalSumDep ~ Groups, data = Stresstable)

Residuals:
    Min      1Q  Median      3Q     Max
-5.2152 -3.1617 -1.6617  0.9989 14.7848

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.0011     0.9137   3.285  0.00162 **
Groups        1.1071     0.6705   1.651  0.10331
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 4.824 on 68 degrees of freedom
Multiple R-squared:  0.03855,  Adjusted R-squared:  0.02441
F-statistic: 2.726 on 1 and 68 DF,  p-value: 0.103
```

Anxiety:

```
Call:
lm(formula = TotalSumAnx ~ Groups, data = Stresstable)

Residuals:
   Min     1Q Median     3Q    Max
-3.701 -3.683 -1.701  1.817 32.313

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  3.70088    1.09600   3.377  0.00122 **
Groups      -0.01435    0.80425  -0.018  0.98582
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 5.787 on 68 degrees of freedom
Multiple R-squared:  4.681e-06,       Adjusted R-squared:  -0.0147
F-statistic: 0.0003183 on 1 and 68 DF,  p-value: 0.9858
```

Stress:

```
Call:
lm(formula = TotalSumStr ~ Groups, data = Stresstable)

Residuals:
    Min      1Q  Median      3Q     Max
-9.4912 -5.4912 -0.9564  3.2219 16.8653

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   9.4912     1.3295   7.139 7.96e-10 ***
Groups       -0.3565     0.9756  -0.365    0.716
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 7.019 on 68 degrees of freedom
Multiple R-squared:  0.00196,	Adjusted R-squared:  -0.01272
F-statistic: 0.1335 on 1 and 68 DF,  p-value: 0.7159
```

G. T-test's result

Cognitive dissonance:

```
Welch Two Sample t-test

data:  RowAvg by Groups
t = -0.38487, df = 38.556, p-value = 0.7024
alternative hypothesis: true difference in means between group 1 and group
2 is not equal to 0
95 percent confidence interval:
 -0.9125435  0.6208769
sample estimates:
mean in group 1 mean in group 2
       2.520833        2.666667
```

Enrichment:

```
Welch Two Sample t-test

data:  RowAvg by Groups
t = 1.2748, df = 27.631, p-value = 0.213
alternative hypothesis: true difference in means between group 1 and group
2 is not equal to 0
95 percent confidence interval:
 -0.4474439  1.9196661
sample estimates:
mean in group 1 mean in group 2
       5.958333        5.222222
```

H. Procedures table

Procedures	Amount in veterinary-research group	Amount in human-research group	Amount in non-animal group
Care taking	11	7	
Taking blood	15	9	
Treatment (vaccinating, medicine testing, etc.)	18	9	
Observing	23	13	
Surgery	3	8	
Euthanizing	16	12	
Postmortem	12	9	
Cell culture assays			20
In vitro assays (e.g. ELISA'S, PCR'S)			22
Chemical assays			6
Other	7	9	5