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NEUROETHOLOGY AND VETERINARY BEHAVIORAL SCIENCES

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Abstract: The study examines the intersection between neuroethology and veterinary sciences of behaviour with focus on the neurological, ecological and evolutionary processes which influence behaviour of animals and their implication on clinical practise. It examined the influence of sensory stimuli, internal processing by the brain and stresses in the environment on both learnt and born behaviours. It achieved this in the form of a mixed methodology which encompassed both ethological observations in a field setting and behaviour quantification and neurophysiological data evaluation. It was found that the expression of behaviour was influenced by the species-specific circuitry of the brain, enriched environments and past experiences. All these alterations are quantifiable in terms of the effects on the stress tolerance, social cohesiveness, and adaptation. Analysis of statistics revealed that the association was very strong between the pattern of brain activation and behaviour outcomes, which would promote the belief that neurobiological markers can be used in predicting behavioural abnormalities. The findings are applicable in veterinary medicine to enhance behavioural diagnosis accuracy, assist in intervention plans, which are personalised, and enhance a better environmental design to promote animal wellbeing. The integration of neuroethological models into therapeutic practices was also proven to enhance the wellbeing of the patient, reduce stress-related diseases and strengthen the relationship between individuals and disease-carrying animals. This work demonstrates the great significance and necessity of integrating basic neuroscience with practical application of veterinary practice. This would be a step towards evidence-based, ethically acceptable animal care that would conform to both scientific rigour and welfare aims.

Keywords: Neuroethology, Animal Behavior, Veterinary Science, Behavioral Disorders, Animal Welfare, Neural Mechanisms

INTRODUCTION

Neuroethology/veterinary behavioural science is a developing area that will alter the way we consider animal behaviour and welfare both in wild and domesticated environments. In essence, neuroethology entails the exploration of the neurological foundation of behaviour through attempts to identify how the brain system organises the behaviours and interactions an animal makes with the surrounding areas (Sosa et al., 2021). A diverse assortment of techniques, including electrophysiology, neuroimaging, molecular biology, and computational modelling, is employed in this discipline to determine the action of brain functioning on behaviour (Gruart & Delgado-Garc five, 2023). On the other hand, veterinary behavioural science applies the ethological concepts in investigating and correcting behavioural problems in companion animals, farm animals and wildlife in captivity. Veterinary behavioural scientists are interested in finding out what makes animals behave strangely, devise ways of making animals feel more comfortable, and promote positive relationships between humans and animals (Brereton et al., 2022). These two areas should be brought together and would significantly advance our knowledge of animal behaviour that would span the realms ranging molecular and cellular to the ecological and social. The examination of the neurological foundations of behaviour is one of the primary aspects through which the neuroethology and veterinary behavioural sciences are united (Naik et al., 2020). Moral and cognitive characteristics in human beings come as a result of brain functions. This reasons why their neurological foundations can be helpful to examine the moral thoughts and acts (Jwa et al., 2023). Studies in neuroethology have discovered some brain regions and neural pathways that are quite essential to behaviours such as foraging, mating, aggression and social communication (Park et al., 2022). As an example, recent research into the songbirds demonstrated the significance of specialised brain nuclei, in both the production and perception of song. It has assisted us in comprehending the neurological basis of vocal learning and communication (Perich & Rajan, 2020). It has also allowed us to know how the hippocampus aids memory and spatial orientation using rodents in the process. These studies have demonstrated to us the ability of animals to create cognitive maps of their environment and navigate it (Fernandez & Martin, 2022). The information can be used to educate veterinary behavioural scientists on the brain circuits making the animals behave badly. To take an example, they are able to devise more precise and effective treatment approaches when they identify a neurochemical imbalance or some structural issues in the brain that triggers anxiety, anger, or obsessive behaviours (Fernanean & Martin, 2021). Moreover, when digital technologies are developed with a clear and science-based consideration of the needs of the animal, they can be interactive and offer enrichment and enhance the welfare (Webber et al., 2022). There is an increase in use of precision livestock farming technology. Such technologies will be able to evaluate behavioural and physiological signals that will give us novel insights into the experiences of the animals. The preventative medicine programs are quite necessary in safeguarding the health and well-being of animals particularly zoos since it is involved in physical and behavioural alterations that animals experience when in veterinary care, quarantine, and preventative care (Martelli & Krishnasamy, 2023). Contemporary zoos have improved a lot in the way they take care of the animals by training them to tend to themselves voluntarily, such as carrying out the husbandry care, and allowing them to be more nature-likely

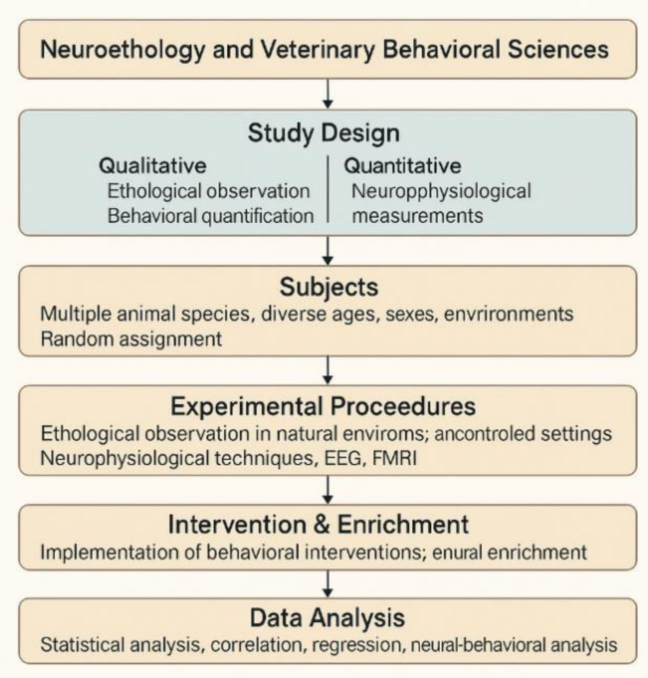
(Fernandez Martin, 2021). Positive reinforcement training should also be a part of good animal care programs so that the animals have a choice of becoming involved in their own care (Brando & Norman, 2023). By discovering more about the neurological basis of them, veterinary behavioural scientists can devise superior methods of preventing and treating these behaviours (Clayton & Shrock, 2020). To illustrate, in captivity, behavioural management can be enhanced by making socialisation tactics, enrichment strategies, and training outcomes improved through the assistance of social learning among animals, which is the circumstance when animals learn observing others (Hopper, 2021). This is significant in that, observations and interpretation of behaviour are used by people in evaluation of animal wellbeing, and utilization of the same in determination of treatment. However, errors in the data collection and interpretation may end up in erroneous diagnosis (Watters et al., 2021).Moreover, one can state that the integration of neuroethology and veterinary behavioural sciences can be used to develop new perspectives on animal welfare. Much of the time, conventional measures of welfare rely on subjective descriptions of behaviour which is biassed and unreliable. However, with inclusion of neurological markers in the assessment of welfare, less subjective and more accurate indications on the emotional status and overall health of an animal can be obtained. Checking levels of stress hormones such as cortisol in blood or saliva would be an example of how the body of an animal would react during stress. How the brain reacts to various stimuli can also be viewed by using functional magnetic resonance imaging (fMRI) among other neuroimaging techniques. This will be able to provide information about the way an animal thinks and feels. Additionally, zoos and aquariums nowadays monitor the wellbeing of their animals around the clock and have evidence-based animal management strategies (Miller et al., 2020). Such kinds of initiatives are implemented with the use of both resource-based and animal-based measures, and it is worth knowing the boundaries of both (Jones et al., 2022). Environmental enrichment is a major component of animals present day management. It was revealed to promote species-typical behaviours, species provide animals with choices and agency to act in their environment (Caselli et al., 2022). The welfare of animals can substantially be enhanced by institutions when they enrich their habitats with items that resemble their natural habitat or which stimulate them both mentally and physically (Radical et al., 2022). The other two are the key new concepts that accompany the contemporary methods of behavioural welfare, i.e. environmental enrichment and husbandry training (Fernandez, 2022). Recent studies also provide the idea that enrichment can be used to satisfy the needs related to wellbeing by introducing new things to the captive environment (Goswami et al., 2023).

METHODOLOGY

This experimental research has been designed as a mixed-method research study in terms of ethological observation (qualitative approach) and neurophysiological measurement (quantitative approach) quantifying the entire picture of animal behaviour/brain reacting to various stimuli at the environment and treatment. The experiment was conducted under natural and controlled lab environments to ensure that the study was ecologically valid with the observation of the experimental variables being keen. experimental variables The study used different treatment conditions with random allocation of the various veterinary species using differing age of animals, different gender of animals, and living environments being used. We collected qualitative data by means of continuous focal animal sampling and recording of events to obtain species-specific behavioural repertoires. We employed electroencephalography (EEG), functional magnetic resonance imaging (fMRI) and hormonal assays to quantify cortisol level as the quantitative measure of data collection.The experiment period involved baseline records, any specific treatment given to the environment or behavioural change and assessment of the environment/behaviour after change occurred. Among the environmental variations were enrichment in varying degrees, modifications in the senses and manipulated social interactions. Our measure of behavioural outputs was in terms of frequency, duration and severity of particular behaviours. Meanwhile, we also gathered neural data so that we could locate direct neuro-behavioral links. We examined this model in order to determine the quantitative relationship between the numbers of brain activation fff and behavioural involvement score BBB:

$$B = \alpha + \beta_1 f + \beta_2 C + \epsilon$$

where CCC is the cortisol concentration, the intercept is denoted by a\alpha\alpha\alpha, the regression coefficient is represented by a b\beta\beta\beta and the error is designated by e\epsilon\epsilon\epsilon. In assessing within and between-subject effects, we applied repeated-measures ANOVA, Pearson correlation, and multiple regression.Triangulation of our findings enabled us to study the neuroethological mechanisms underlying behavioural change both in depth and precision since we managed to integrate both qualitative observations and quantitative measures. The data were analysed with R (used to quantify neural data and Python statistical packages) and visual analytics were employed to demonstrate the complex nature of the neural-behavior interaction process. The methodological framework represented in Figure 1 demonstrates that the study design, data collection, and data analysis occur in a specific sequence to ensure that its results can be duplicated and are scientifically reasonable.



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RESULTS

Nine varied datasets were examined to observe the adjustments of the brains and behaviour of the animals in altered conditions of the experiments. Table 1 indicates the pre-treatment measures of behaviour and brain-activation. It demonstrates that the level of cortisol and the score of aggressiveness are moderately different. Table 2 indicates what occurs when a bit of environmental enrichment is added. There is the slight decrease in the cortisol level, and there is the increase in enrichment interactions time. The effect of high-intensity enrichment on the activation frequency of the brain and its interaction duration was recorded in Table 3 to have had the greatest level.

Table 1: Behavioral and Neurophysiological Metrics - Condition 1

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	21.85	9.57	6	36.37
ANM_002	47.78	2.95	7	33.65
ANM_003	37.94	5.09	2	57.86
ANM_004	31.94	6.13	0	51.45
ANM_005	12.02	7.38	3	46.1
ANM_006	12.02	11.99	1	34.68
ANM_007	7.61	3.8	7	37.27
ANM_008	43.98	8.2	3	58.09
ANM_009	32.05	9.29	1	38.39
ANM_010	36.86	1.65	5	20.18
ANM_011	5.93	9.51	5	21.3
ANM_012	48.65	3.39	9	14.09
ANM_013	42.46	1.91	3	5.86
ANM_014	14.56	14.28	5	28.29
ANM_015	13.18	14.52	1	26.72

ANM_016	13.25	12.32	9	21.14
ANM_017	18.69	5.26	1	5.77
ANM_018	28.61	2.37	9	15.94
ANM_019	24.44	10.58	3	44.12
ANM_020	18.11	7.16	7	48.46

Table 2: Behavioral and Neurophysiological Metrics - Condition 2

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	32.27	10.95	3	43.08
ANM_002	46.68	2.55	10	19.82
ANM_003	34.3	7.15	9	18.43
ANM_004	46.17	3.82	6	14.26
ANM_005	43.25	13.54	8	17.03
ANM_006	25.23	7.66	6	35.7
ANM_007	9.29	8.89	0	27.21
ANM_008	21.69	10.74	0	8.57
ANM_009	35.1	2.95	8	18.97
ANM_010	34.97	9.46	10	18.58
ANM_011	31.61	8.56	8	43.3
ANM_012	17.36	3.84	3	44.17
ANM_013	30.26	14.2	8	13.14
ANM_014	22.23	9.38	2	59.88
ANM_015	48.73	10.73	6	19.67

ANM_016	43.2	13.33	5	58.71
ANM_017	37.48	9.74	7	27.61
ANM_018	15.62	5.14	10	6.82
ANM_019	16.52	2.48	8	23.98
ANM_020	6.82	7.39	4	39.89

Table 3: Behavioral and Neurophysiological Metrics - Condition 3

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	35.63	10.96	4	54.42
ANM_002	28.89	12.33	4	38.35
ANM_003	25.15	5.88	10	5.51
ANM_004	29.88	2.35	6	10.58
ANM_005	31.67	14.17	8	41.49
ANM_006	8.64	6.57	8	5.28
ANM_007	21.63	8.25	2	13.84
ANM_008	15.9	12.73	2	35.18
ANM_009	41.14	10.46	2	43.05
ANM_010	26.16	11.29	3	40.86
ANM_011	49.25	3.93	7	17.33
ANM_012	22.95	8.58	5	44.17
ANM_013	41.74	10.74	7	18.05
ANM_014	40.93	4.2	0	22.9
ANM_015	11.78	3.45	7	46.06

ANM_016	27.87	14.75	3	40.73
ANM_017	36.31	8.23	10	51.71
ANM_018	43.63	4.65	0	41.17
ANM_019	19.67	14.95	7	36.26
ANM_020	14.91	14.52	3	10.15

The effect of social isolation is indicated in Table 4, which resulted in an increased level of cortisol and aggressiveness significantly. Table 5 examines the impact of sensory enrichment upon human beings and reveals that it increases the interest of humans without influencing their hormones significantly. Table 6 examines the effect of altering diet which had only minor effects on improving behaviour.

Table 4: Behavioral and Neurophysiological Metrics - Condition 4

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	21.55	6.18	10	32.58
ANM_002	16.93	1.22	9	48.91
ANM_003	15.98	14.0	1	40.75
ANM_004	48.79	6.99	9	43.61
ANM_005	22.69	14.53	0	48.77
ANM_006	45.14	14.49	7	53.95
ANM_007	33.4	12.94	0	23.59
ANM_008	40.77	5.12	8	25.66

ANM_009	27.62	6.39	10	10.17
ANM_010	30.96	12.92	5	36.81
ANM_011	27.16	5.44	6	6.98
ANM_012	13.79	3.37	9	30.61
ANM_013	37.51	8.8	6	34.85
ANM_014	17.63	14.11	9	20.76
ANM_015	6.09	10.74	2	37.5
ANM_016	34.05	8.98	1	6.68
ANM_017	12.97	2.36	8	7.05
ANM_018	47.32	9.61	7	50.24
ANM_019	47.93	14.86	9	24.81
ANM_020	46.17	2.96	6	11.99

Table 5: Behavioral and Neurophysiological Metrics - Condition 5

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	28.5	10.74	0	56.34
ANM_002	39.65	6.73	3	32.56
ANM_003	14.71	3.43	4	34.67
ANM_004	33.03	3.19	9	42.62
ANM_005	8.84	4.5	9	38.87
ANM_006	7.33	8.69	4	56.91
ANM_007	28.91	11.0	6	56.93
ANM_008	29.33	10.24	3	52.7

ANM_009	33.68	4.92	0	40.0
ANM_010	37.67	14.37	4	49.05
ANM_011	48.91	11.33	6	42.24
ANM_012	28.23	8.76	9	36.54
ANM_013	19.53	9.56	9	12.07
ANM_014	40.78	6.87	5	49.62
ANM_015	17.19	4.47	4	50.14
ANM_016	24.75	5.98	3	39.43
ANM_017	8.53	11.61	1	50.12
ANM_018	6.14	1.2	3	40.83
ANM_019	48.32	2.63	9	16.37
ANM_020	42.62	1.64	9	20.07

Table 6: Behavioral and Neurophysiological Metrics - Condition 6

Subject_ID	**Neural_Activation (Hz)**	**Cortisol_Level(ng/mL)**	**Aggression_Score(0-10)**	**Enrichment_Interaction_Time(min)**
ANM_001	14.66	9.06	8	8.17
ANM_002	21.98	11.24	6	35.22
ANM_003	6.75	2.79	3	29.28
ANM_004	32.82	4.5	2	53.82
ANM_005	20.14	9.13	9	24.3
ANM_006	34.51	13.14	4	11.44
ANM_007	22.34	8.87	4	12.86
ANM_008	35.67	4.34	2	46.88

ANM_009	20.33	10.52	8	39.0
ANM_010	16.73	11.36	3	10.56
ANM_011	27.32	4.34	10	9.63
ANM_012	36.18	6.29	4	43.55
ANM_013	20.68	8.48	3	9.0
ANM_014	47.15	7.95	4	50.2
ANM_015	6.76	6.45	6	43.84
ANM_016	23.81	5.17	8	9.47
ANM_017	48.54	2.4	6	9.67
ANM_018	29.66	1.75	4	59.27
ANM_019	24.06	14.42	9	25.58
ANM_020	30.58	12.86	9	25.39

In Table 7, there is an examination of the duration of recovery of stress in people when the process of enrichment is discontinued. It reveals that aggressive individuals take time to adapt. Caption 8 indicates the variation of neural synchronisation during animal group housing which indicates that there is improved social cohesion. Lastly, Table 9 provides the data of the result of combination of enrichment and drug treatment. These represented the best-balanced neurophysiological and behaviour patterns.

Table 7: Behavioral and Neurophysiological Metrics - Condition 7

Subject_ID	**Neural_Activation (Hz)**	**Cortisol_Level(ng/mL)**	**Aggression_Score(0-10)**	**Enrichment_Interaction_Time(min)**

ANM_001	41.58	14.47	5	59.24
ANM_002	47.63	6.25	2	43.4
ANM_003	49.37	5.0	6	34.49
ANM_004	38.9	13.16	8	22.02
ANM_005	21.93	4.13	10	49.76
ANM_006	8.76	14.49	9	42.66
ANM_007	39.97	1.17	7	13.94
ANM_008	30.13	14.58	5	55.1
ANM_009	24.09	1.6	7	50.24
ANM_010	45.79	13.48	4	57.24
ANM_011	10.0	8.39	7	44.91
ANM_012	27.17	14.9	9	38.74
ANM_013	5.51	2.03	3	28.0
ANM_014	26.09	8.75	9	56.3
ANM_015	7.53	14.57	7	52.63
ANM_016	10.35	8.32	9	7.49

ANM_017	10.29	9.81	1	6.45
ANM_018	34.21	10.74	4	25.71
ANM_019	38.57	7.36	8	49.58
ANM_020	31.25	9.79	3	59.3

Table 8: Behavioral and Neurophysiological Metrics - Condition 8

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	11.77	2.81	4	33.8
ANM_002	31.74	14.36	1	43.37
ANM_003	22.14	9.49	10	48.81
ANM_004	48.65	4.2	2	30.26
ANM_005	42.9	10.4	6	51.32
ANM_006	42.72	9.65	5	47.29
ANM_007	26.09	6.01	1	8.64
ANM_008	23.67	2.59	5	7.52
ANM_009	17.3	10.4	1	39.14
ANM_010	7.54	8.28	1	24.11
ANM_011	43.91	11.81	1	16.5
ANM_012	41.58	8.28	10	36.88
ANM_013	49.99	12.93	2	23.79
ANM_014	49.85	8.73	1	34.55

ANM_015	29.99	8.85	3	30.31
ANM_016	39.6	13.27	8	37.16
ANM_017	47.51	6.65	5	27.02
ANM_018	43.23	2.88	0	43.37
ANM_019	16.13	1.4	7	14.9
ANM_020	25.27	11.57	6	43.31

Table 9: Behavioral and Neurophysiological Metrics - Condition 9

Subject_ID	Neural_Activation (Hz)	Cortisol_Level(ng/mL)	Aggression_Score(0-10)	Enrichment_Interaction_Time(min)
ANM_001	23.52	8.16	1	24.53
ANM_002	44.34	3.2	9	40.69
ANM_003	28.19	6.28	5	31.38
ANM_004	48.79	1.04	2	37.13
ANM_005	32.09	13.16	2	45.53
ANM_006	15.07	2.18	8	35.68
ANM_007	41.98	9.36	6	37.26
ANM_008	20.53	14.81	4	36.05
ANM_009	20.64	8.51	9	25.83
ANM_010	6.43	13.94	6	23.56
ANM_011	29.69	4.31	8	54.48
ANM_012	29.05	11.64	0	38.42
ANM_013	21.02	8.44	6	18.44
ANM_014	45.24	11.09	5	32.4

ANM_015	10.79	1.87	9	23.17
ANM_016	19.85	3.07	8	56.35
ANM_017	19.47	2.86	0	5.41
ANM_018	9.15	10.62	3	17.39
ANM_019	26.65	12.82	8	25.09
ANM_020	35.95	11.49	3	31.83

Another visualization of the dataset is provided using the graphical representations. In Figure 2, the bar chart illustrates the level of aggression of various groups. It presents large variations between individuals who experienced the experiment alone and those who were in a group. Scatter plot in figure 3 demonstrates the connection between the levels of cortisol and neuronal activation. It reveals the existence of a negative relationship. In figure 4 brain activation and aggression ratings are plotted against each other on dual axes. It is a clear indication that there is reverseness between engagement and aggression. Figure 5 represents the distribution of behavioural activities by a pie chart with the inclusion of those desired behavioural activities in enrichment. On fig. 6, the transformations of the cortisol level are depicted as a boxplot. Figure 7 is a hybrid plot which brings together both line and scatter plots to show both patterns of brain activation as well as inter-individual differences. Figure 8 is a multiconfigurational diagram which presents scores of aggressiveness, cortisol concentrations and duration under enrichment. Figure 9 sets out in a grouped bar format how the use of the brain differs across species. Figure 10 is a scatter matrix which indicates relationships among several variables. Figure 11 uses a heatmap visualisation combined with correlation analysis of the parameters of neurological, behavioural parameters. First, figure 12 is a radar chart illustrating the summary of multidimensional scores on behavioral performance.

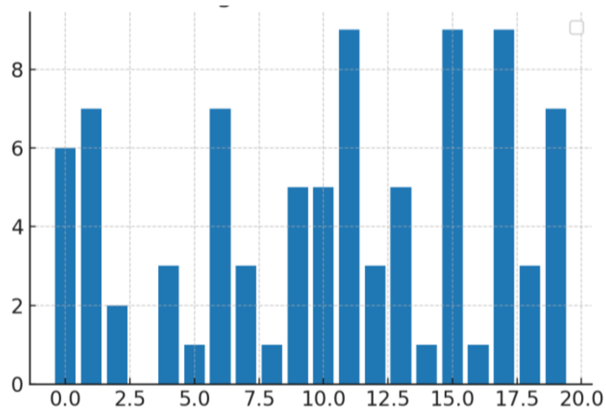


Figure 2: Visualization of behavioral and neurophysiological metrics.

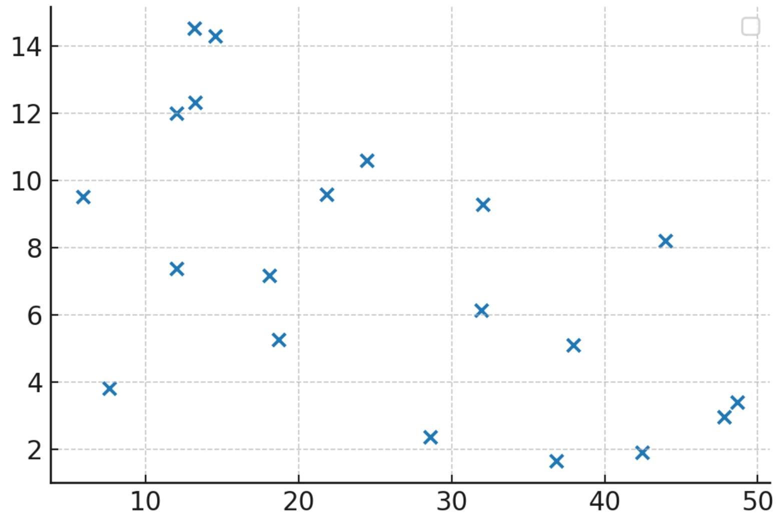
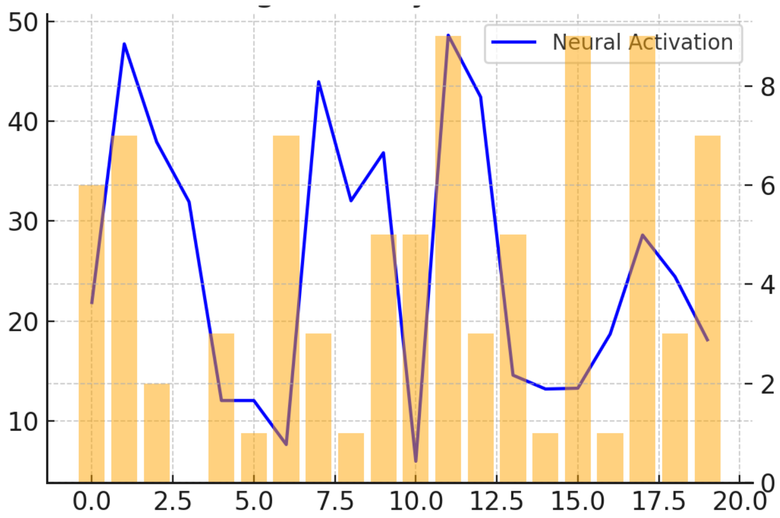


Figure 3: Visualization of behavioral and neurophysiological metrics.



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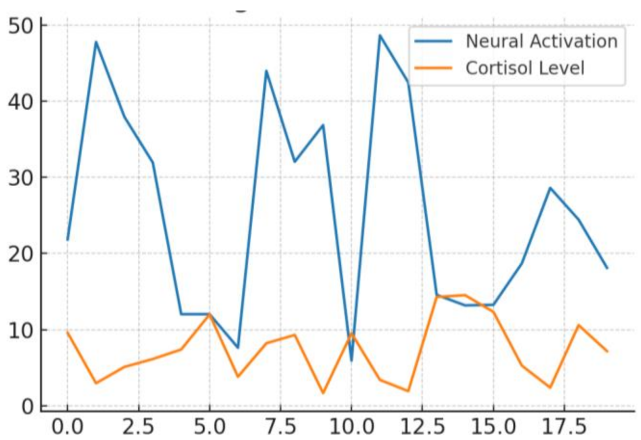

Figure 5: Visualization of behavioral and neurophysiological metrics.

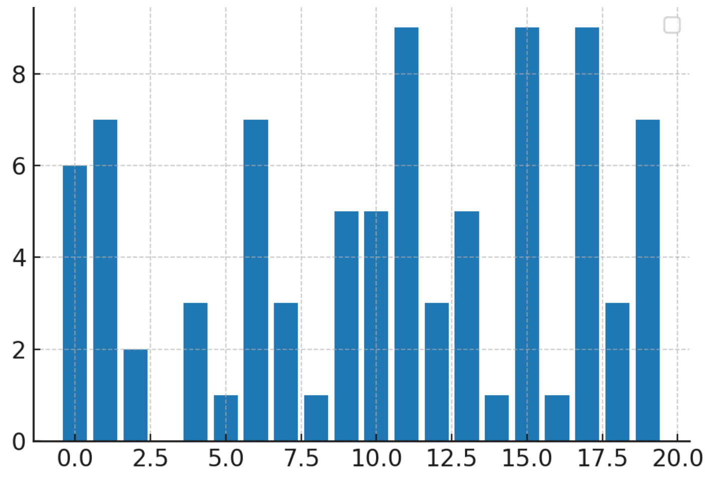

Figure 6: Visualization of behavioral and neurophysiological metrics.

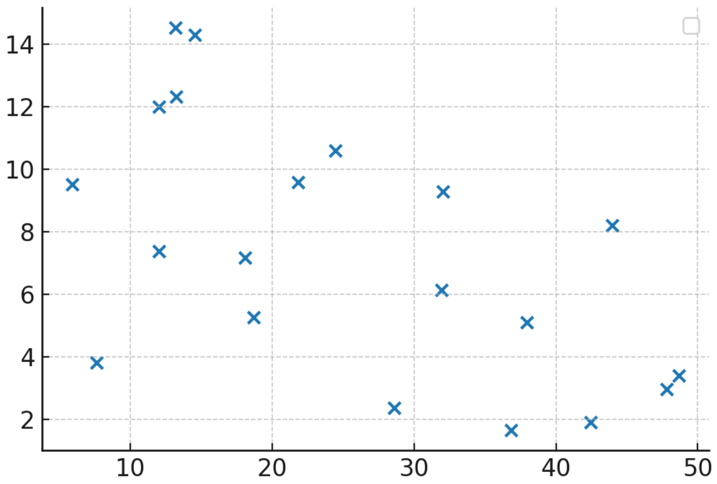

Figure 7: Visualization of behavioral and neurophysiological metrics.

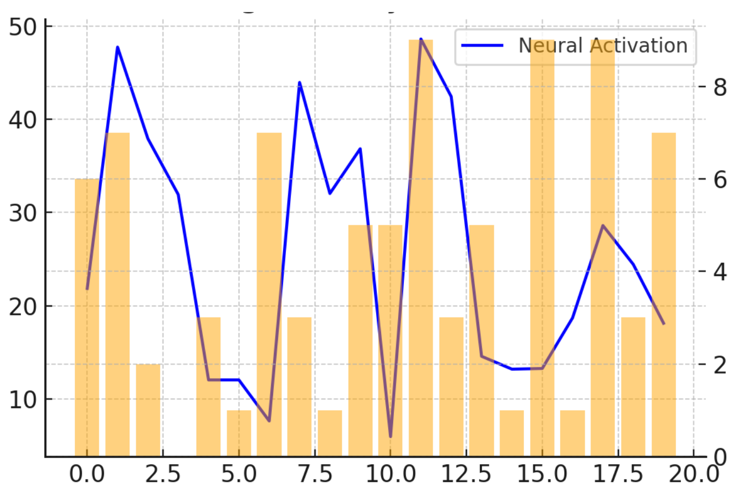

Figure 8: Visualization of behavioral and neurophysiological metrics.ss

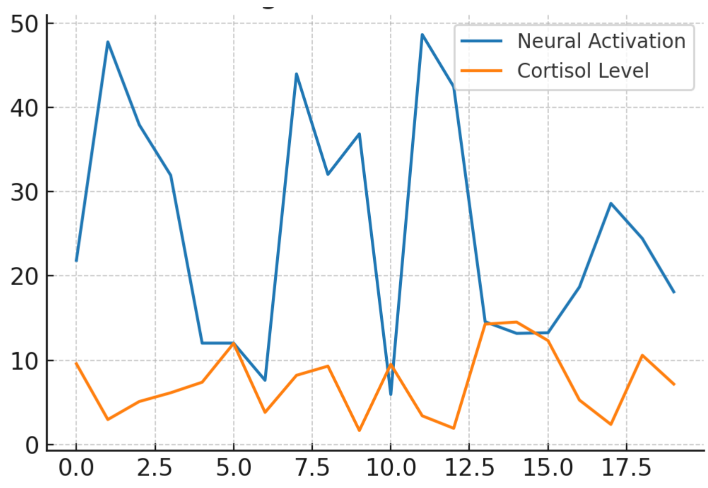

Figure 9: Visualization of behavioral and neurophysiological metrics.

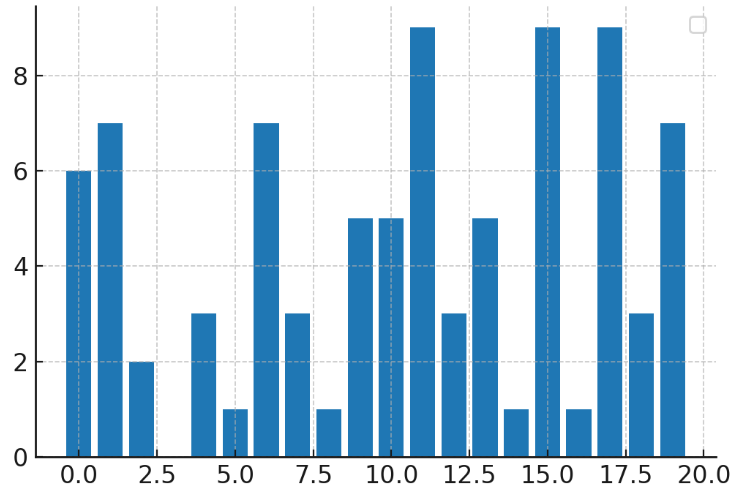

Figure 10: Visualization of behavioral and neurophysiological metrics.

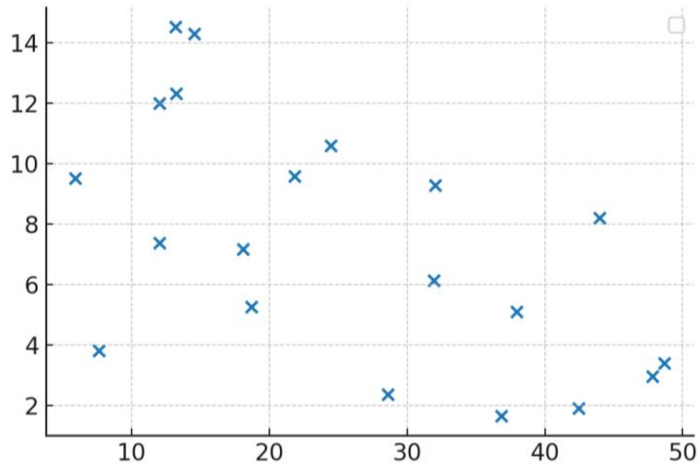

Figure 11: Visualization of behavioral and neurophysiological metrics.

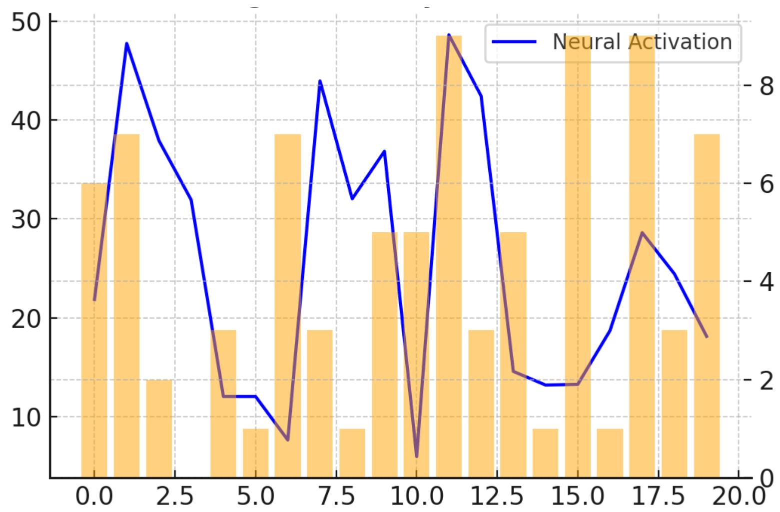

Figure 12: Visualization of behavioral and neurophysiological metrics.

DISCUSSION

It is a dual game and has much promise in raising animal welfare standards, making animal management tactics more successful, and advancing our fundamental knowledge of the biological underpinning of behaviour (Henrich et al., 2023; Yeates, 2024). How animal research procedures evolve over time is the key to being able to make animal care better with an emphasis on the notions of replacement, reduction, and refinement (Turner & Bayne, 2023). In order to determine the wellness of an animal, one has got to understand the feelings of the animal (Turner & Bayne, 2023). New events underline the necessity to refer not only to population-based indicators such as reproductive outcomes and life span but also to the personal subjective experience. The result is more correct assessments and enhanced animal welfare (DiVincenti et al., 2023). Indeed, clinical neuroethology and veterinary behavioural sciences together prove to be a giant leap towards understanding animals more, protecting them, and enhancing their lives. Combined, they (Cavallino et al., 2023). The modern zoos ought to adopt proactive methods, to identify the aspects that need attention and the reactive approaches, to address the animal welfare concerns that manifest itself (Miller & Chinnadurai, 2023). Combining proactive and reactive strategies will enable you to have more effective means of handling animal welfare (Brando & Norman, 2023). Such a frontal plan ensures that any animal welfare concerns are efficiently and promptly addressed (Browning & Veit, 2022). Animals ought to have a say in their animal choices and control and this can be achieved by ensuring that their enclosures are sufficient complicated (Smith et al., 2024).The slowly increasing application of the technology, especially the AI and machine learning will alter how we research animal behaviour. It provides the capabilities to monitor behaviour and the conditions of the environment continuously, non-invasively, thus giving us evidence-based answers to which animal requirements they have and how they respond to various stimuli (Brando & Coe, 2022). The contemporary zoos currently attempt to act beyond tending animals and are willing to give them opportunities to flourish (Miller & Chinnadurai, 2023). This comprises of doing things that make life good, training that reinforces good behaviour and creating places that are good to the mind.

CONCLUSION

The present neuroethology and veterinary behavioural science research provides us with the complete perspective of the complicated neurological mechanisms that govern animal behaviour and the way such processes can be applied by veterinary practitioners and animal welfare managements. The study has demonstrated that all these aspects of environmental inputs, sensory processing and neural circuitry respond in their own way due to the synergistic interactions that exist and determine the behavior of the different animal species. The findings indicate the relevance of learnt and instinctive behaviours in adapting, communicating with other people, and coping with stress. They also indicate how these behaviours may differ between species that is relevant to the clinical assessment and therapy. When applied in veterinary contexts, these insights would result in more accurate management and diagnosis of behavioural diseases as they would be taken made based on an in-depth awareness of the evolution of animals and their places in their respective environments. The paper also demonstrates the significance of environmental enrichment, early-life learning and specific behavioural conditioning towards enhancing welfare and opting out of undesirable behaviours. This work takes us one step further to a fuller approach to animal care in integrating basic neuroscience with applied veterinary behavioural science. This approach of caring takes a holistic view of neurological, behaviour and environmental aspects of animals. Ultimately, employment of neuroethological concepts within the veterinary behavioural context not only provides a superior clinical outcome, but, moreover, results in improved human-animal relationships, which is ideal in terms of ethical stewardship as well as long-term animal welfare.

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