Journal of
Zoological and Botanical Gardens

MDPI

Opinion

Improving Zoo Exhibit Design: Why We Need Temporary Exhibit Design

James Edward Brereton [1,*], Jon Coe [2,†] and Eduardo J. Fernandez [3,*]

1 Higher Education, University Centre Sparsholt, Westley Lane, Sparsholt, Winchester SO21 2NF, UK
2 Jon Coe Design, Healesville, VIC 3777, Australia
3 School of Animal and Veterinary Sciences, The University of Adelaide, Adelaide, SA 5005, Australia
* Correspondence: james.brereton@sparsholt.ac.uk (J.E.B.); eduardo.fernandez@adelaide.edu.au (E.J.F.)
† Retired.

Abstract: Good enclosure design is central to the improvement of conditions for animals housed in zoos and aquaria, yet the study of *a priori* enclosure design or *post hoc* through Post-Occupancy Evaluation (POE) is somewhat limited in the scientific literature. The concept of trialing novel exhibit components before enclosure construction, through a process known as Temporary Exhibit Design (TED), was recently proposed as a strategy to prevent problems that often occur as a result of untested exhibit creation, with a view to ultimately improve welfare outcomes and reduce subsequent exhibit redevelopment. In this paper, we consider the potential input required from three key enclosure design stakeholders: the animal, the visitor, and zoo staff. We also consider the potential benefits for each of these stakeholders when participating in TED, alongside the wider zoo organizational benefits. TED has the potential to reduce construction costs and post-construction redevelopment, enhance animal welfare, and ensure that educational messages are effectively communicated.

Keywords: animal–visitor interactions; enclosure design; habitat; post-occupancy evaluation; prototype testing; zoo design

check for updates

Academic Editor: Lance Miller

Received: 28 January 2025
Revised: 25 February 2025
Accepted: 6 March 2025
Published: 13 March 2025

Citation: Brereton, J.E.; Coe, J.; Fernandez, E.J. Improving Zoo Exhibit Design: Why We Need Temporary Exhibit Design. *J. Zool. Bot. Gard.* **2025**, *6*, 19. https://doi.org/10.3390/jzbg6010019

Copyright: © 2025 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

The development of well-considered exhibit design is fundamentally important for the improvement of conditions for zoo and aquarium-housed animals [1]. Historically, hygiene was considered to be one of the most important tenets of enclosure design, and as such, many exhibits were built that were constructed largely of concrete, ceramic tile, and metal for easy cleaning [2,3]. More recently, most modern zoos prioritize naturalistic exhibits that promote natural behavior on the part of their animals, as well as offering choice and control when developing their enclosures [4–6]. Therefore, exhibit designs continue to evolve in response to changing professional and societal views on animals.

While care and attention are taken when developing a new enclosure, the methods of enclosure development are often based on tradition, such as copies of earlier exhibits, and architectural premises, rather than from an evidence-based, scientific perspective [7]. For instance, many new exhibit designs borrow directly from previously built exhibits, thereby creating a system where such architectural blueprints are often recycled [8]. Examples of designs that are sometimes copied include the African savanna enclosure; an exhibit in which several large herbivore species are featured in a large, grass-covered exhibit. While copying appears to be an appealing strategy, it often means that the copier of the design is less aware of the original research that went into the design. Thus, issues including potential animal incompatibility, strategies for separating individuals, or safety features may be overlooked. The integration of science in design is therefore relatively rare, occasionally appearing in the form of a Post-Occupancy Evaluation (POE) once the exhibit is already constructed [9]. Identification of problems in design (*a priori*, from an animal, staff, or visitor standpoint) would normally result in post-build adjustments to ameliorate the identified problems [10].

Rather than wait until an enclosure is designed to identify challenges, the alternative of Temporary Exhibit Design (TED) was recently proposed [11]. In TED, exhibit prototypes are built and trialed, allowing for the collection of data on animal and visitor preferences for specific designs. These preferences are then integrated into the resulting enclosure plans, ultimately reducing the likelihood of post-build reconstruction projects. While the concepts of TED have already been featured in museum literature for decades [12,13], these concepts remain relatively novel for zoos. This paper addresses some of the potential benefits in engaging with TED for zoos, focusing on the animal, visitor, staff, and wider zoo perspective. If used consistently in upcoming enclosure designs, TED has the potential to reduce enclosure management costs, improve staff morale and engagement, and improve animal welfare outcomes.

2. Animals

The development of a new exhibit design is often, though not always, a collaboration among general architects, landscape architects, and zoo managers, with varied amounts of input from staff such as keepers and gardeners [7,14,15]. While some architects have zoo specialism, they are relatively rare, and as such, mainstream architects are often used [16–18]. Ideally, architects and their exhibit designs are guided by both information on the individual animals to be exhibited, as well as the exhibited species' natural histories. This information should be provided by zoo staff and species experts, who are able to highlight these points and feed them into the exhibit blueprints. If this communication does not happen, exhibits may be of limited relevance to their inhabitants or will require extensive modification in order to address animal needs.

By trialing components before use, TED allows for the empirical assessment of the needs of the individual animals which are to be housed in the new exhibit. Preference testing, for example, may identify individual idiosyncrasies: these can then be factored into the wider exhibit [19]. Group-level challenges may also be identified, such as exhibit components that encourage aggression or affiliation between individual animals.

One key area that TED could be crucial is in improving human–animal interactions in zoos and aquaria [20]. It is known that interaction with visitors at zoos can be enriching, detrimental, or of no consequence to zoo animals (i.e., the visitor effect) [21–23], and that the salience of these interactions differs among species, exhibits, and individuals. Visitor presence is largely unavoidable for animals in public zoos, so staff may try to either reduce the impact of visitors, or present visitors in a way that is non-threatening. The benefits of developing affiliative interactions between animals and visitors are manifold [24]: positive interactions may reduce animal stress reactions, with the potential of reducing stress-related injury and infection, increasing reproductive success, and lengthening lifespan, whilst also facilitating husbandry-related activities [25]. It is therefore important that affiliative design strategies are considered carefully. Fortunately, many strategies have already been identified, including exhibiting animals above visitors, so that the visitor is not looking down on the animal, as in the traditional bear pit, and the use of double-glazed glass to reduce visitor noise for sound-sensitive species [26]. TED could be used to trial new methods of engagement between animals and people, in a way that can be rapidly removed if it is ineffective, or if the animals find the interaction aversive.

In TED, temporary enclosure features are built cheaply and introduced to animals, to determine their impact on behavior, including preference or avoidance of some possible feature [27,28]. Behavioral data are collected by professionals, and this information is used to inform the exhibit design process. The benefits to the animal are considerable. First, animal exhibits are likely to be more mindful of the individual needs of the animals due to being housed, which means that fewer modifications to the enclosure are needed. Animals would also be able to 'choose' their preferred exhibit elements, at least with respect to the types of exhibit elements tested. Finally, how different types of exhibit spaces allow visitors to interact with animals could be directly tested for their visitor effect on welfare. For instance, the use of netting or barriers could be used with present exhibits to help assess their impact on visitor behavior, as well as how eventual permanent features in a newly designed exhibit might impact the animals.

3. Visitors

As the primary source of income, visitor satisfaction is essential for the continued survival of most public zoos and aquaria globally [29]. Zoos need to interact with these visitors in ways that are sufficiently engaging so that visitors are likely to enjoy the experience (and therefore make a return visit), but also to provide conservation education messaging that is meaningful and effective [30–33]. Ultimately, some zoos now aim to promote 'behavior change' in their visitors, in which individuals alter aspects of their daily behavior to become more conservation-minded following a zoo trip [34]. Behavior change is challenging to achieve, and even more challenging to empirically measure in zoo visitors [35]. Zoos therefore have a challenge in identifying which forms of education are most effective in promoting the conservation message whilst continuing to engage the public.

Fortunately, a wide array of literature already exists that evaluates zoo interpretation strategies and their suitability [34–36], with some of these interpretive features being prototyped before construction using formative evaluation methods [37]. While formative evaluation is sometimes used in the zoo, the literature tends to focus more on evaluation of interpretation, only after the exhibits and educational displays have already been built. Thus, this approach results in *post hoc* modification of ineffective interpretation, which is likely to incur additional expenses and wasting of resources. This reduces the ability of the zoo to modify interpretation if it is deemed ineffective: even removal of the ineffective resources is likely to incur expenses.

The benefits of applying a TED approach from a visitor perspective are manifold. For example, TED can be used to (1) assess the potential visitor enjoyment of a new exhibit, which can be performed through survey responses to TED at existing exhibits [37–41]; (2) evaluate visitor education, particularly with respect to what visitors learn from TED and therefore continue to learn from the future exhibit [42]; and (3) empirically evaluate visitor experience behaviors, such as crowd size and visitor length of stay [37,38]. In this case, varying forms of signage or technology can be cheaply applied around an enclosure, and feedback from visitors can be used to gain understanding of signage suitability [43]. Alternatively, visitors could be recruited to walk through a makeshift test enclosure and provide feedback on potential problems, such as accessibility or animal visibility. The use of virtual walkthroughs, by guiding visitors through a virtual enclosure using virtual reality technology, may also be effective [44]. The use of memory retention techniques such as drawings of the exhibit by visitors may also be effective [44]. Visitor dwell time and engagement with interpretation can also be observed: this avoids some of the social desirability bias associated with self-reporting from visitors [39]. Although limited to approximations of the eventual constructions, assessment via TED of prototyped features can allow researchers and staff to assess factors such as dwell time and engagement with exhibit features.

4. Staff

Evaluation and input of new exhibit creations by staff is not always formally evaluated or published. Post-Occupancy Evaluation of a new enclosure may include keepers and aquarists, but this still rarely incorporates formal (empirical) evaluation, and is a simplified outlook [45]. While zookeepers and aquarists are likely to work with their respective enclosures on a daily basis, other types of zoo staff also interact with enclosures occasionally, and as such, staff needs and interactions with animals and their exhibits should be taken into account. Other types of staff that may be found working in or around animal enclosures include presenters and education staff, veterinarians, gardeners, and maintenance staff including plumbers and electricians.

Staff are considered less frequently in enclosure design in comparison to animal and visitor stakeholders [44,46], and in some cases, this results in unfortunate design faults which can increase the labor time and difficulties of working safely around an exhibit. Examples include drainage systems that are located high in the enclosure, thus requiring staff to move water uphill for drainage [2] or exhibits that contain no keeper space for the storage of husbandry equipment, thus requiring keepers to visit storerooms to collect equipment [7]. While these challenges initially appear somewhat trivial, their long-term impact from an organizational perspective may be considerable. For example, a keeper who is required to manually push water up a slope to drain for 15 min each day is likely to eventually become disenchanted with the activity. This lack of enthusiasm may feed into the keeper's general perception of their job role, thus decreasing overall job satisfaction [47]. The financial impacts of the drainage alone are considerable: a job that takes an extra 15 min per day would take 105 staff minutes per week, equating to 91 h per year: at least two full weeks of paid staff hours. This example relates to a single enclosure: if multiple enclosure faults exist within a collection, the wider impact on financial viability may be considerable. Enclosure spaces that are tricky to work with are similarly likely to cause loss of morale or additional organizational expenses if staff need to take time off work due to accidents [48].

In additional to health, safety, and efficiency needs, staff such as vets, keepers, and presenters also need to safely access their animals in ways that promote positive human–animal relationship (HAR) development [49]. These interaction points need to be considered carefully, considering the varied sensitivities and risks associated with each taxonomic group [48]. Here, opportunities exist for applying TED, so that these methods are trialed and the effects on animal behavior and welfare can be quantified. Nonetheless, how can zoo staff contribute effectively to a TED program?

Staff could aid in gathering data for other elements of TED by acting as animal researchers. Using standardized ethograms or by assessing preferences, keepers can collect meaningful data on their animals [50]. This could be useful in upskilling members of staff, whilst also allowing them to provide feedback as to which design elements were effective for their study species.

In terms of reducing design faults, staff can be involved in developing a human-centric TED. Here, a mock version of an exhibit could be developed out of cheap, available materials such as cardboard. The exhibit is built to the same size specifications that the actual enclosure would be, allowing staff to visualize the exhibit, and identify problems that are likely to occur (e.g., is there room to maneuver in the keeper areas). This allows for rapid adjustments to designs to be made before any construction has taken place. In addition, temporary features proposed as permanent structures in a new exhibit, such as crates and swings, could be added to existing exhibits and tested for how they impact staff interactions, including the ability to move (i.e., shift) animals off-exhibit. Finally, non-TED aspects that are still exhibit design-relevant, such as formal staff surveys, could be incorporated into all of the above, which would allow for a more complete evaluation of exhibit design prior to the creation of such a new exhibit.

The benefits arising from involving staff in TED are considerable. The individuals who work most closely with the enclosure and animals on a daily basis are also the most likely to identify design faults and could provide novel ideas on account of their understanding as to how their animals may respond to design components. Engaging with staff during the design process may also allow them to feel more engaged with the construction process, thus encouraging them to champion the resulting designs.

5. Considerations Concerning Use of TED

While there are clear benefits to TED, the uptake of this design strategy is likely to be faced by initial challenges. First, the initial design planning process is likely to take longer than would be expected for a traditional exhibit and result in completion date uncertainty. This is because initial design components need to be tested using rigorous, scientific methods, then fed back to the project manager. The feedback from these trials is likely to result in design edits, and in some cases, even in further trials as alternative enclosure components are developed. There are costs in designer, builder, researcher, and staff time and construction materials attributed to prototyping. Additionally, care and consideration need to be given to ensure that staff are equipped with sufficient skills to carry out the tasks that they have been given. It is essential that, in addition to training, time is devoted to ensuring that there is good interobserver reliability between individuals.

Recommendations resulting from TED trials may also increase final construction costs. Extending design and thus overall project timelines and injecting uncertainty often increases architectural costs and may require unpredictable extra costs for design changes. This makes project design and construction cost estimation uncertain. There may therefore be a temptation to avoid running through these complex TED components, and instead to simply design an exhibit based on existing plans from other collections.

The integration of TED into normal exhibit design processes could aid in developing enclosure designs that have never been seen before in zoos, ideally with a focus on positive human–animal interactions [28]. Brand new exhibits could be trialed, and therefore also rapidly discarded if they are deemed not to be appropriate to the study species. Additionally, TED has the added benefit of passively gathering datasets for both zoo education strategies and animal welfare during the normal processes of trialing exhibit components. This species-specific knowledge may fill gaps in the existing zoo literature in terms of welfare assessments and positive welfare indicators, especially for species that remain largely understudied [51]. By integrating staff into the assessment process, the staff are now better-informed to run welfare audits for the species that they keep, and in the case of lesser-known taxa, to make progress in better understanding species' behavior and biology. Thus, TED has the potential to deliver far more than just the better-informed exhibit design that was originally proposed. As such, TED could be viewed as an investment in time and money: one that, through early expenditure into exhibit creation, results in savings through planned preparation and the consideration of all stakeholders, animals, visitors, and staff alike.

6. Conclusions

If the concept of TED is applied in new builds or renovation, the cost of construction could be reduced considerably by avoiding *post hoc* modification of the exhibit and reducing the amount of staff time required to engage in everyday husbandry and maintenance activities. Furthermore, the trialing of exhibit components before construction may improve welfare outcomes, as animals are more likely to be housed in exhibits that are structurally relevant for their species-specific and individual needs, and as such, disruptive *post hoc* enclosure edits are likely to be kept to a minimum. The collection of data allows enclosure designs to be evidence-based, rather than untested until animals are added to the enclosure or copied from another existing enclosure in another zoo. In utilizing TED, future enclosures are likely to be accepted by animals, visitors, and staff, and are likely to place less financial burden on animal care facilities.

Author Contributions: Conceptualization, J.C. and E.J.F.; methodology, J.C. and E.J.F.; writing—original draft preparation, J.E.B.; writing—review and editing, J.E.B., E.J.F. and J.C.; visualization, J.E.B.; supervision, J.C. and E.J.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Data Availability Statement: No data were generated as part of this study.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. de Azevedo, C.S.; Cipreste, C.F.; Pizzutto, C.S.; Young, R.J. Review of the Effects of Enclosure Complexity and Design on the Behaviour and Physiology of Zoo Animals. *Animals* **2023**, *13*, 1277. [CrossRef]
2. Hosey, G.; Melfi, V.; Pankhurst, S. *Zoo Animals: Behaviour, Management, and Welfare*; OUP Oxford: Oxford, UK, 2013; ISBN 9780199693528.
3. Brando, S.; Coe, J. Confronting Back-of-House Traditions: Primates as a Case Study. *J. Zool. Bot. Gard.* **2022**, *3*, 366–397. [CrossRef]
4. Coe, J.C. Design and Perception: Making the Zoo Experience Real. *Zoo Biol.* **1985**, *4*, 197–208. [CrossRef]
5. Ritzler, C.P.; Lukas, K.E.; Bernstein-Kurtycz, L.M.; Koester, D.C. The Effects of Choice-Based Design and Management on the Behavior and Space Use of Zoo-Housed Amur Tigers (*Panthera tigris altaica*). *J. Appl. Anim. Welf. Sci.* **2023**, *26*, 256–269. [CrossRef] [PubMed]
6. Rust, K.; Clegg, I.; Fernandez, E.J. The Voice of Choice: A Scoping Review of Choice-Based Animal Welfare Studies. *Appl. Anim. Behav. Sci.* **2024**, *275*, 106270. [CrossRef]
7. Melfi, V.; Bowkett, A.; Plowman, A.; Pullen, K. *Do Zoo Designers Know Enough About Animals*; Whitley Wildlife Conservation Trust: Paignton, UK, 2005; pp. 119–127.
8. Powell, D.M. Collection Planning for the next 100 Years: What Will We Commit to Save in Zoos and Aquariums? *Zoo Biol.* **2019**, *38*, 139–148. [CrossRef]
9. Kelling, N.J.; Gaalema, D.E.; Kelling, A.S. A Modified Operational Sequence Methodology for Zoo Exhibit Design and Renovation: Conceptualizing Animals, Staff, and Visitors as Interdependent Coworkers. *Zoo Biol.* **2014**, *33*, 336–348. [CrossRef]
10. Snyder, R.J.; Barrett, L.P. Postoccupancy Evaluation of Staff, Visitors, and Three Species of Animals in a Zoo Setting. *Zoo Biol.* **2023**, *42*, 75–85. [CrossRef]
11. Fernandez, E.J.; Brereton, J.E.; Coe, J. How Do We Plan for the Zoo Exhibit of the Future? *Appl. Anim. Behav. Sci.* **2023**, *268*, 106085. [CrossRef]
12. Davies, S.M. The Co-Production of Temporary Museum Exhibitions. *Mus. Manag. Curatorship* **2010**, *25*, 305–321. [CrossRef]
13. Economou, M. The Evaluation of Museum Multimedia Applications: Lessons from Research. *Mus. Manag. Curatorship* **1998**, *17*, 173–187. [CrossRef]
14. Kerr, S. Effective Interaction in a Natural Science Exhibit. *Curator Mus. J.* **1986**, *29*, 265–277. [CrossRef]
15. McCarthy, C. Zoo Design: A Collaborative Process Examining How Zoo Development Professionals and Landscape Architects Cooperate in Developing Exhibits-ProQuest. Available online: https://www.proquest.com/openview/422ac178a7769cb18f7cfa898121f2d1/1?pq-origsite=gscholar&cbl=18750 (accessed on 10 January 2025).
16. Coe, J.C. An Integrated Approach to Design: How Zoo Staff Can Get the Best Results from New Facilities. In Proceedings of the First Annual Rhino Keeper's Workshop, Orlando, FL, USA, 7–9 May 1999; pp. 1–5.
17. Fernandez, E.J.; Chiew, S.J. Animal-Visitor Interactions: Effects, Experiences, and Welfare. *Anim. Behav. Cogn.* **2021**, *8*, 462–467. [CrossRef]
18. Kelling, A.S.; Gaalema, D.E. Postoccupancy Evaluations in Zoological Settings. *Zoo Biol.* **2011**, *30*, 597–610. [CrossRef] [PubMed]

19. Turner, J.T.; Whittaker, A.L.; McLelland, D.J.; Hanson, S.L.; Fernandez, E.J. Preference Test Design in Applied Animal Settings: A Scoping Review. *Appl. Anim. Behav. Sci.* **2025**, *282*, 106476. [CrossRef]
20. Fernandez, E.J.; Sherwen, S.L. *Human-Animal Interactions in Zoos: Integrating Science and Practice*; CABI: Wallingford, UK, 2024; ISBN 9781800622685.
21. Fernandez, E.J.; Tamborski, M.A.; Pickens, S.R.; Timberlake, W. Animal–visitor interactions in the modern zoo: Conflicts and interventions. *Appl. Anim. Behav. Sci.* **2009**, *120*, 1–8. [CrossRef]
22. Hosey, G.R. Zoo animals and their human audiences: What is the visitor effect? *Anim. Welf.* **2000**, *9*, 343–357. [CrossRef]
23. Sherwen, S.L.; Hemsworth, P.H. The visitor effect on zoo animals: Implications and opportunities for zoo animal welfare. *Animals* **2019**, *9*, 366. [CrossRef]
24. Coe, J. Zoo Design Winners or Losers: How Do We Measure Success? Available online: https://www.researchgate.net/publication/294131878_How_do_we_measure_design_success_8 (accessed on 10 January 2025).
25. Williams, E.; Hunton, V.; Hosey, G.; Ward, S.J. The impact of visitors on non-primate species in zoos: A quantitative review. *Animals* **2023**, *13*, 1178. [CrossRef]
26. Coe, J. Increasing Affiliative Behavior Between Zoo Animals and Zoo Visitors. 2000. Available online: https://joncoe.net/wp-content/uploads/2021/10/Increase-Affiliative-Behavior.pdf (accessed on 10 January 2025).
27. Brereton, J.E.; Fernandez, E.J. Which index should I use? A comparison of indices for enclosure use studies. *Anim. Behav. Cogn.* **2021**, *9*, 119–132. [CrossRef]
28. Fernandez, E.J. Training as Enrichment: A Critical Review. *Anim. Welf.* **2022**, *31*, 1–12. [CrossRef]
29. Andersen, L.L. Zoo Interpretation and Exhibit Design: Two Sides of the Same Coin. *J. Mus. Educ.* **1991**, *16*, 4–6. [CrossRef]
30. Fernandez, E. What Are We Doing to Measure Conservation Support from Zoo Visitors. *AZA Conserv. Educ. Comm. Newsl.* **2019**, *13*, 14–15.
31. Godinez, A.M.; Fernandez, E.J. What Is the Zoo Experience? How Zoos Impact a Visitor's Behaviors, Perceptions, and Conservation Efforts. *Front. Psychol.* **2019**, *10*, 1746. [CrossRef]
32. McNally, X.; Webb, T.L.; Smith, C.; Moss, A.; Gibson-Miller, J. A Meta-analysis of the Effect of Visiting Zoos and Aquariums on Visitors' Conservation Knowledge, Beliefs, and Behavior. *Conserv. Biol.* **2024**, *39*, e14237. [CrossRef]
33. Spooner, S.L.; Farnworth, M.J.; Ward, S.J.; Whitehouse-Tedd, K.M. Conservation Education: Are Zoo Animals Effective Ambassadors and Is There Any Cost to Their Welfare? *J. Zool. Bot. Gard.* **2021**, *2*, 41–65. [CrossRef]
34. Smith, L. Zoos and Behaviour Change. In *Handbook on Tourism and Behaviour Change*; Ramkissoon, H., Ed.; Edward Elgar Publishing: Cheltenham, UK, 2023; pp. 51–63, ISBN 9781800372498/9781800372481.
35. Edney, G.; Smart, T.; Howat, F.; Batchelor, Z.E.; Hughes, C.; Moss, A. Assessing the Effect of Interpretation Design Traits on Zoo Visitor Engagement. *Zoo Biol.* **2023**, *42*, 567–576. [CrossRef]
36. Learmonth, M.J.; Chiew, S.J.; Godinez, A.; Fernandez, E.J. Animal-Visitor Interactions and the Visitor Experience: Visitor Behaviors, Attitudes, Perceptions, and Learning in the Modern Zoo. *Anim. Behav. Cogn.* **2021**, *8*, 632–649. [CrossRef]
37. Matiasek, J.; Luebke, J.F. Mission, Messages, and Measures: Engaging Zoo Educators in Environmental Education Program Evaluation. *Stud. Educ. Eval.* **2014**, *41*, 77–84. [CrossRef]
38. Learmonth, M.J.; Sherwen, S.; Hemsworth, P.H. Assessing Preferences of Two Zoo-housed Aldabran Giant Tortoises (*Aldabrachelys gigantea*) for Three Stimuli Using a Novel Preference Test. *Zoo Biol.* **2021**, *40*, 98–106. [CrossRef]
39. Moss, A.; Esson, M. Visitor Interest in Zoo Animals and the Implications for Collection Planning and Zoo Education Programmes. *Zoo Biol.* **2010**, *29*, 715–731. [CrossRef] [PubMed]
40. Bitgood, S.; Patterson, D.; Benefield, A. Exhibit Design and Visitor Behavior: Empirical Relationships. *Environ. Behav.* **1988**, *20*, 474–491. [CrossRef]
41. Collins, C.K.; McKeown, S.; O'Riordan, R. Does an Animal–Visitor Interactive Experience Drive Conservation Action? *J. Zool. Bot. Gard.* **2021**, *2*, 473–486. [CrossRef]
42. Moss, A.; Jensen, E.; Gusset, M. Impact of a Global Biodiversity Education Campaign on Zoo and Aquarium Visitors. *Front. Ecol. Environ.* **2017**, *15*, 243–247. [CrossRef]
43. Clay, A.W.; Perdue, B.M.; Gaalema, D.E.; Dolins, F.L.; Bloomsmith, M.A. The Use of Technology to Enhance Zoological Parks. *Zoo Biol.* **2011**, *30*, 487–497. [CrossRef] [PubMed]
44. Coe, J. Children's Drawings: New Tools for Zoo Exhibit Evaluation. *Visit. Stud.* **1989**, *2*, 87–100. [CrossRef]
45. Maple, T.L.; Finlay, T.W. Post-Occupancy Evaluation in the Zoo. *Appl. Anim. Behav. Sci.* **1987**, *18*, 5–18. [CrossRef]
46. Coe, J. Zoo Animal Enclosure Design Basics: Nature Is the Model. Available online: https://zoolex.org/media/uploads/2018/07/29/coe_keynote.pdf (accessed on 10 January 2025).
47. Scholten, M.; Correia, M.F.; Esteves, T.; Gonçalves, S.P. No Place for Pointless Jobs: How Social Responsibility Impacts Job Performance. *Sustainability* **2022**, *14*, 12031. [CrossRef]
48. Gore, M.; Hutchins, M.; Ray, J. A Review of Injuries Caused by Elephants in Captivity: An Examination of Predominant Factors. *Int. Zoo Yearb.* **2006**, *40*, 51–62. [CrossRef]

49. Hosey, G. A Preliminary Model of Human–Animal Relationships in the Zoo. *Appl. Anim. Behav. Sci.* **2008**, *109*, 105–127. [CrossRef]
50. Goodenough, A.E.; Sewell, A.; McDonald, K. Behavioural Patterns in Zoo-Housed Humboldt Penguins (*Spheniscus humboldti*) Revealed Using Long-Term Keeper-Collected Data: Validation of Approaches and Improved Husbandry. *Appl. Anim. Behav. Sci.* **2023**, *258*, 105811. [CrossRef]
51. Melfi, V.A. There Are Big Gaps in Our Knowledge, and Thus Approach, to Zoo Animal Welfare: A Case for Evidence-Based Zoo Animal Management. *Zoo Biol.* **2009**, *28*, 574–588. [CrossRef] [PubMed]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.