Inspiring Pro-Conservation Behavior through Innovations in Zoo Exhibit and Campaign Design

by

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Abstract

Amid rapidly increasing anthropogenically caused wildlife extinctions, zoos are often expected to embrace the role of proactive conservation organizations. Many are leading the way through innovations in the development of engaging visitor experiences. This paper evaluates the effectiveness of the new and cutting-edge immersive interpretation within the TigerTrek Exhibit at Taronga Zoo (Sydney, Australia), for its ability to influence visitors to engage in pro-conservation behaviors related to certified sustainable palm oil advocacy and consumerism. Survey data were collected from zoo visitors prior to entering the Sumatran Tiger Trek exhibit ($n = 514$), upon exiting the exhibit ($n = 509$), and by email at six-week ($n = 106$) and six-month ($n = 18$) intervals post-visit to investigate the immediate and long-term impacts of the exhibit on visitors' pro-conservation behavioral intentions and actual behaviors. Results indicate an increase in post-visit respondents' levels of awareness ($\chi^2 = 65.26$ (1), $p < .001$), motivation ($t = -6.976$ (1029), $p < .000$) and behavior intentions ($t = -5.256$ (1042), $p < .000$), however, post-visit respondents also reported increased levels of concern that all palm oil is grown unsustainably ($\chi^2 = 9.09$ (1), $p < .01$), which runs contrary to interpretive messaging. Follow up surveys revealed after both six-weeks and six-months post-visit; 29.2% of respondents purchased a product because it contained Certified Sustainable Palm Oil, however, 50% of six-week respondents had actively avoided buying a product because it contained palm oil. By understanding how visitors perceive the interpretive messaging within an exhibit and appreciating the types of conservation behaviors visitors are willing and able to engage in, zoos can more effectively achieve their conservation campaign goals.

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Chapter 1 - Introduction

Background

The exceptionally rapid loss of biodiversity over the last few centuries indicates that we may have entered Earth's sixth mass extinction event (Ceballos et al., 2015). While anthropogenic actions have been a major contributing factor to recent massive biodiversity decline (Dirzo et al., 2014), it is still possible to divert further decay of biodiversity and subsequent loss of ecosystem services through urgent and intensified conservation efforts (Ceballos et al., 2015). Around 700 million people visit the world's zoos and aquariums each year (Grajal, 2017), affording these organizations with an opportunity to deliver experiences that may stimulate the wider community to engage in individual behavior change as leverage for broad-scale social, legislative and market change (Dunstan, Fairbrother, & Van Sluys, 2016).

Taronga Zoo in Sydney, Australia has recognized the critical importance of the human dimensions of wildlife conservation and has a vision to 'secure a shared future for wildlife and people' (Walraven, & Duffy, 2017). They are creating transformational experiences that encourage and empower their 1.7 million visitors each year to make better choices, champion causes and change their behavior to achieve positive outcomes for wildlife. Their most recent development is the immersive Tiger Trek; an Indonesian-themed exhibit that provides an opportunity to get up-close with Sumatran Tigers and learn how simple actions can help to protect their wild habitat.

Sumatran Tigers (*Panthera tigris* ssp. *Sumatrae)* are categorized as critically endangered on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species, with an estimated wild population of less than 400 individuals. The Sumatran Tiger population is declining due to high rates of habitat loss and fragmentation (Whittle et al., 2012)

with much of the forest conversion attributed to the plantation of oil palm trees. Almost all oil palm grows in areas that were once tropical forests and Indonesia is the world's leading palm oil producer (Vijay, Pimm, Jenkins, & Smith, 2016). Palm oil is the most widely traded vegetable oil globally and when compared to other major oilseed crops, palm oil accounts for the smallest percentage (5.5%) of all the cultivated land for oils and fats globally but produces the largest percentage (32%) of total output, making it by far the most efficient oil to feed a growing global population with the decreasing land available for agriculture (Oosterveer, 2015). Despite these advantages, the impact of oil palms growing on high conservation value land is an issue that need to be adequately addressed. Production and use of sustainable palm oil, following guidelines from the Roundtable on Sustainable Palm Oil (RSPO) will help to maintain or enhance biological, ecological and social values in the countries of origin (Oosterveer, 2015).

The Tiger Trek exhibit at Taronga Zoo aims to educate visitors about the threats facing wild Sumatran Tiger populations; focusing on unsustainable palm oil and its impact on Sumatran Tiger habitat, while highlighting the benefits of sustainably sourced palm oil and encouraging visitors to act both on-site and off-site to support to use of sustainable palm oil.

The Tiger Trek exhibit builds on the community conservation campaign called Don't Palm Us Off, developed by Zoos Victoria in 2009 as a joint undertaking for Australasian zoos to advocate for the mandatory labelling of palm oil in all food products in Australia and New Zealand (Dunstan, Fairbrother, & Van Sluys, 2016). This was one of the earliest examples of Australasian Zoos coming together on a major issue threatening biodiversity, and it encouraged zoos to embrace social science and behavior change theories to develop profound experiences that reflect a deliberate shift beyond merely awareness-raising and onto facilitating large-scale societal pro-conservation behavior change (Dunstan, Fairbrother, & Van Sluys, 2016).

A recent collaborative examination by Zoos Victoria and the Taronga Conservation Society Australia (Dunstan, Fairbrother, & Van Sluys, 2016) used the Don't Palm Us Off Campaign as a case study to highlight the ability of zoos to play a unique role in behavior change. That examination identified that the challenge is to ensure that, once the audience is inspired to act, there is an associated call-to-action provided immediately that is tangible, measurable and solution-focused (Dunstan, Fairbrother, & Van Sluys, 2016). Taronga Zoo embraced this challenge in the design of their new Tiger Trek exhibit and this study aims to provide Taronga Zoo with data-based indicators of their success in driving behavior change.

Previous behavior change studies have shown that interpretation, exhibit design, and species themselves can all influence visitors' intention to engage in pro-conservation behaviors (Banks & Dunstan, 2014; Skibins & Powell, 2013; Skibins, Powell, & Stern, 2012; Smith, Broad, & Weiler, 2008). However, few studies have taken measures to account for barriers and ability factors or measured the temporal component of behavior change, such as pre-existing dispositions towards the behaviors, lag time to actual execution and the longevity of behavior adoption. Furthermore, visitor behaviors are seldom linked to specific outcomes (e.g., palm oil consumerism), but rather, focus on broad unaligned actions such as recycling, or generic philanthropy. By focusing on one species (Sumatran Tiger) and a specific set of behaviors directly related to long-term conservation (Certified Sustainable Palm Oil consumerism) this study was able to isolate, identify, measure, and evaluate the individual effects of the experiential, cognitive and affective components of pro-conservation behavior change.

The Connect-Understand-Act model created by Zoos Victoria (Squires, Lowry, & Banks, 2016) is a concept that arose from environmental education programs and has been widely used throughout zoos in Australasia as part of community conservation campaign strategy

development, including by Taronga Zoo in the development of the Tiger Trek exhibit. While this study acknowledges the important role this model has played in encouraging zoos to embrace behavior change practices and conservation psychology, this model was not utilized as part of the evaluation in this study due to the simplistic and linear nature of the model. This study utilized a modified version of the Integrated Model of Behavior Change (De Vries, Reubsaet & De Nooijer, 2004) from the field of human health sciences. This model was selected due to the comprehensive incorporation of many more factors contributing to behavior change, including predisposing factors, information, awareness, motivation, intention, ability and barriers, and the model was modified for optimal applicability for the objectives of this study.

In order to address the aforementioned temporal components of behavior change, this study collected data across four time-points within a six-month period. Three different survey instruments were developed, with the first being utilized to gather baseline data from zoo visitors who have not yet visited the TigerTrek Exhibit. The second and most comprehensive survey tool was administered to zoo visitors immediately upon exiting the TigerTrek Exhibit and a short follow-up survey was administered via email at six-weeks and six months post-visit to measure the longevity of behavior adoption.

Problem Statement

Social science research in the field of pro-conservation behavior change commonly measures intentions to change behavior but often fails to measure the actual and temporal components of behavior change, including the lag time to execution, and longevity of behavior adoption. Past studies have focused heavily on the impact of knowledge, values and norms on intention to change behavior but have neglected to measure a holistic, complex and interconnected system of influencing factors including predisposing factors, experiential factors, ability factors and barriers. Furthermore, visitor behaviors are seldom linked to specific outcomes, but rather, focus on broad unaligned environmental actions.

Purpose Statement

This study analyzed the effectiveness of the new TigerTrek Exhibit in its ability to inspire visitors to engage in behaviors that support Sumatran Tiger conservation with a particular focus on supporting products that are made using only Certified Sustainable Palm Oil. This study will utilize the Integrated Model of Behavior Change (De Vries, Reubsaet & De Nooijer, 2004) which will allow for quantitative analyses to identify the relative importance of a holistic suite of influencing factors, including predisposing, experiential, motivation, and ability factors and barriers. This study will also measure the temporal components of behavior change including lag time to execution and the longevity of behavior adoption.

Chapter 2 - Manuscript

Abstract

Amid rapidly increasing anthropogenically caused wildlife extinctions, zoos are often expected to embrace the role of proactive conservation organizations. Many are leading the way through innovations in the development of engaging visitor experiences. This study evaluates the effectiveness of the new and cutting-edge immersive interpretation within the TigerTrek Exhibit at Taronga Zoo (Sydney, Australia), for its ability to influence visitors to engage in pro-conservation behaviors related to certified sustainable palm oil advocacy and consumerism. Survey data were collected from zoo visitors prior to entering the Sumatran Tiger Trek exhibit ($n = 514$), upon exiting the exhibit ($n = 509$), and by email at six-week ($n = 106$) and six-month ($n = 18$) intervals post-visit to investigate the immediate and long-term impacts of the exhibit on visitors' pro-conservation behavioral intentions and actual behaviors. Results indicate an increase in post-visit respondents' levels of awareness ($\chi^2 = 65.26$ (1), $p < .001$), motivation ($t = -6.976$ (1029), $p < .000$) and behavior intentions ($t = -5.256$ (1042), $p < .000$), however, post-visit respondents also reported increased levels of concern that all palm oil is grown unsustainably ($\chi^2 = 9.09$ (1), $p < .01$), which runs contrary to interpretive messaging. Follow up surveys revealed after both six-weeks and six-months post-visit; 29.2% of respondents purchased a product because it contained Certified Sustainable Palm Oil, however, 50% of six-week respondents had actively avoided buying a product because it contained palm oil. By understanding how visitors perceive the interprative messaging within an exhibit and appreciating the types of conservation behaviors visitors are willing and able to engage in, zoos can more effectively achieve their conservation campaign goals.

Literature Review

The rapid loss of biodiversity over the last few centuries indicates that we may have entered Earth's sixth mass extinction event (Ceballos et al., 2015). While anthropogenic actions have been a major contributing factor to recent biodiversity decline (Dirzo et al., 2014), it is still possible to prevent further erosion of biodiversity and subsequent loss of ecosystem services through urgent and intensified conservation efforts (Ceballos et al., 2015). Myers, Mittermeier, Mittermeier, Fonseca, & Kent (2000) ascertained the best way to prioritize conservation resources to benefit the most species at the least cost was to identify 'biodiversity hotspots', which they defined as biogeographic units where exceptional concentrations of endemic species are undergoing exceptional loss of habitat. Globally, these biodiversity hotspots only cover 1.4% of land but 57% of all International Union for the Conservation of Nature (IUCN) red-listed threatened terrestrial vertebrates are endemic to these hotspots (Brooks, et al., 2002), and 34 of these hotspots are in Southeast Asia.

The tropical forest ecosystems of Southeast Asia are exceptionally rich reservoirs of much of the biodiversity on Earth, due to the geologically complex history of this island region and its stable, tropical climate (Sodhi, Koh, Brook, & Ng, 2004). However, Southeast Asia also has the highest relative rate of habitat loss of any tropical region. From Southeast Asia, there are currently 20 species listed as critically endangered and 686 species listed as vulnerable to extinction on the IUCN red-list. The loss of many of these regional populations would likely result in global extinctions because of the high proportion of endemic species (Sodhi, Koh, Brook, & Ng, 2004). Sodhi, et al., (2004) forecast Southeast Asia could lose 75% of its original rainforests and 42% of its biodiversity by 2100. However, these impacts are likely to be a vast

underestimate, owing to the paucity of data from the region (Sodhi, Koh, Brook, & Ng, 2004). While the long-term impacts of deforestation are unclear, causes are readily identifiable.

In 2013, Hansen et al., created spatially explicit maps of global gross forest cover loss across the past 12 years and identified Indonesia as having the highest rate of forest cover loss in the world, equaling a loss of over 40 million hectares of forest cover. Wicke, Sikkema, Dornburg and Faaij (2011) compiled data on the causes of land use change in Indonesia and attributed much of the forest cover loss to the sharp increase in palm oil cultivation over the past 30 years. This corresponds with findings by Koh and Wilcove (2008) that Indonesia is currently the world's largest palm oil producing country.

Field studies by Mukherjee and Sovacool (2014) in Indonesia have shown that one of the most concerning environmental impacts of deforestation in Indonesia is the significant decline in quality habitat for large mammals, with fauna on the Indonesian island of Sumatra (Figure 1) being some of the most endangered on earth. These species include the Sumatran Tiger, Sumatran Elephant, Sumatran Orangutan and Sumatran Rhino, all of which are iconic species, impacted directly by habitat loss as well as indirectly through increased forest fires, increased access for poachers and increased opportunities for human-wildlife conflict (Linkie et al., 2003).

Figure 1. Map of Southeast Asia, Indonesia and Sumatra

Palm Oil Plantations and the Implications for Sumatran Tigers

Palm oil is the most widely consumed vegetable oil on the planet, and it is in about half of all packaged products sold in the supermarket according to the World Wildlife Fund (2016). While it is forecast that the international demand for palm oil will continue to rise, this is not innately problematic. Palm oil is the world's highest yielding oil crop, producing on average about 4–5 tons of oil/ha/year, approximately 10 times the yield of soybean oil, the second highest yield (Sumathi, Chai, & Mohamed, 2008). The implication is that palm oil is a much more efficient source of oil to meet the demands of our growing population.

Increasing global demand for palm oil from the food, oleo-chemical, and energy industries, combined with prices up to $780 (USD)/ton has resulted in large profits from the production of palm oil and thus an incentive for producers to expand their operations (Wicke et al., 2011). Koh and Wilcove (2008) claim that palm oil is one of the most rapidly expanding equatorial crops in the world and in 2007, the total cultivated area of palm oil accounted for nearly one-tenth of the world's permanent cropland. Wicks et al., (2011) found that up to 85% of Indonesian palm oil plantations created since 1982 have been on former natural forest, as opposed to previously degraded former rubber, coconut or timber plantations.

However, the conservation impacts of palm-oil production call into question market efficiencies, as plantation development can contribute to deforestation of old-growth forests and the rapid extinction of wildlife, particularly the Sumatran Tiger (Gibbs et al., 2008). A common cycle is for plantation owners to use timber revenue from clearing old-growth forests to subsidize the initial costs of plantation establishment and maintenance (Fitzherbert et al., 2008).

Sumatra has more mammal species than any other Indonesian island but is experiencing the most rapid deforestation in the archipelago (Kinnaird, Sanderson, O'brien, Wibisono, &

Woolmer, 2003). One of the most impacted and notable Sumatran species is the endemic

Sumatran Tiger (*Panthera tigris* ssp. *sumatrae)*, which was once widespread throughout the

island. Sumatran Tigers are categorized as critically endangered on the International Union for

the Conservation of Nature (IUCN) Red List of Threatened Species, with an estimated wild

population of less than 400 individuals.

80% of the deforestation that occurred between 1985 and 2011 was critical Sumatran

Tiger habitat (Brooks et.al., 2002). As apex predators, tigers can only thrive when there is

adequate availability of prey, and the populations of these species depends on the quality of

forest habitat. With less than 400 Sumatran Tigers in the wild, the potential for this species to go

extinct is inordinately high. The loss of such an apex predator and would not only be intrinsically

devastating but could also cause a trophic cascade and potential collapse of the ecosystem

(O'Brien, Baillie, Krueger & Cuke, 2010).

Sustainable Palm Oil

Growing concerns about the environmental impacts of palm oil helped initiate the

Roundtable on Sustainable Palm Oil (RSPO), a nonprofit, industry-led trade organization whose

stated mission is to "promote the growth and use of sustainable palm oil" (Laurance et al., 2010).

Certified sustainable palm oil is palm oil that has been grown on a plantation that has been

managed and certified according to the principles and criteria of the RSPO. To define

sustainability in the palm oil sector, the RSPO has developed sustainability criteria which are

designed to limit environmental impacts of growing and processing palm oil along with a focus

on social and legal concerns (Laurance et al., 2010).

Taronga Zoo is part of the Australasian Responsible Palm Oil Network, a network of 17

leading zoo-based conservation and wildlife organisations across Australia and New Zealand to

urgently drive the transition to certified sustainable palm oil to protect the homes of endangered species. They define certified sustainable palm oil as oil that comes from plantations that have been independently certified as meeting the standards of the RSPO.

This network has recognized zoo-based conservation is well positioned to help break the link between unsustainable palm oil production and deforestation, climate pollution, and human rights abuses, through educating and empowering consumers and suppliers to take actions that support the transition towards a responsible palm oil industry (Fitzherbert, Struebig, Morel, Danielsen, Brühl, Donald & Phalan, 2008). By facilitating change through public audience and stakeholder engagement, they aim to drive the market for responsibly produced palm oil and expose industry laggards contributing to deforestation.

This network recognizes that the palm oil industry plays an important role in employment and economic growth for developing countries. It also acknowledges that moves away from palm oil will likely drive demand elsewhere for other vegetable oils, none of which can meet the high productivity of palm oil per hectare with the smallest footprint when it comes to energy, fertilizer and pesticides (Wilcove & Koh, 2010). Therefore, the primary aims are to mobilize the community, work with Australasian manufacturers to move to 100% segregated certified sustainable Palm Oil use, introduce clear palm oil labelling and support the genuine achievements of companies who are leading the market.

Pro-Conservation Behavior Change

Sumatran Tigers are high profile, charismatic megafauna that capture the imagination of the public and encourage people to support conservation (Walpole, & Leader-Williams, 2002). As such, they are eminently qualified to fulfill the role of flagship species. As defined by Walpole and Leader-Williams (2002), a flagship species operates in the public relations and

fundraising spheres to generate public awareness and financial support for broad conservation action.

There are many means by which the public can support conservation. The majority of campaigns tend to focus on increasing the understanding of issues, promoting sharing of information, and encouraging financial contributions. More recently, Skibins, Powell and Halo (2013) identified the need to focus conservation campaigns on promoting pro-conservation behaviors, while acknowledging that empirical support for behavioral outcomes associated with flagships is lacking. This philosophy goes hand-in-hand with recent recognition by Kareiva and Marvier (2012) that while humans are the main driver of biodiversity threats, they can also drive the solution and are integral to wildlife conservation. This is supported by Dunstan, Fairbrother and Van Sluys (2016) who assert that the definition of wildlife conservation is expanding to include humans as central to the solution and recognize that behavior change theories are becoming critical to campaigns in order to increase the uptake of pro-conservation behaviors.

One of the more significant findings in the field of pro-conservation behavior change is evidence that knowledge is rarely enough to directly motivate behavior change (Braus, 2013; Carmi, Arnon & Orion, 2015). Traditionally, interpreters have adopted an information-based approach, striving to make people more knowledgeable about the environment and related issues in order to achieve the objective of behavioral change (Carmi, Arnon & Orion, 2015; Hungerford & Volk, 1990).

Similarly, the dominant philosophical approach of many conservation campaigns can be summarized in a statement by ecologist Babia Dioum: "In the end, we will conserve only what we love. We only love what we understand. We only understand what we are taught" (Simmons, 1991). Or, in the words of Jane Goodall: "Only if we understand can we care. Only if we care

will we help. Only if we help shall we be saved" (Simmons, 1991). Implicit in these quotes is the notion that knowledge leads to behavior change and environmentally favorable action, which is the ultimate goal of most conservation campaigns (Simmons, 1991). In spite of this, substantial research illustrates how many knowledge focused programs have failed to achieve transformative change (Ramsey, 1993).

Social science literature by Frisk and Larson (2011) clearly highlights the need to go beyond ecological and technical knowledge when educating for transformative action, since sustainable behaviors are motivated by much more than declarative information. In order to effectively educate for sustainability, alternative forms of knowledge (i.e., procedural, effectiveness, and social knowledge) are essential, as is the consideration of various barriers and motivators for action.

The Role of Zoos in the Human Dimensions of Wildlife Conservation

The World Association of Zoos and Aquariums (WAZA, 2017) report that more than 700 million people visit zoos and aquariums globally each year. Research by Carr and Cohen (2011) acknowledge that zoos have historically been defined as sites of public entertainment and still continue to be dependent on the revenue raised through visitor receipts. However, the contemporary justification for zoos is based on their ability to act as sites of wildlife conservation, research, and education, as well as entertainment Dunstan, et al., (2016) recognize that this places zoos in a unique position to inspire and influence visitors to change their behavior to help wildlife.

Dunstan, et al., (2016) identified many modern zoos embrace a multipronged conservation strategy that includes engaging individuals in behavior change strategies within the wider community and leveraging this for broad-scale social, legislative, and market change.

Pursuant to this strategy, zoos have begun to incorporate social science and behavior change theories into programs and exhibits.

For example, the community conservation campaign, 'Don't Palm Us Off', developed by Zoos Victoria in 2009, is a joint undertaking for Australasian zoos to advocate for the mandatory labelling of palm oil in all food products in Australia and New Zealand (Dunstan, Fairbrother, & Van Sluys, 2016). A recent collaborative examination by Zoos Victoria and the Taronga Conservation Society Australia (Dunstan, Fairbrother, & Van Sluys, 2016) used the 'Don't Palm Us Off' campaign as a case study to highlight the ability of zoos to play a unique role in behavior change. That examination identified the challenge is to ensure that, once the audience is inspired to act, there is an immediate and tangible call-to-action that is measurable and solution-focused (Dunstan, Fairbrother, & Van Sluys, 2016).

Taronga Zoo, in Sydney, Australia, has recognized the critical importance of human dimensions of wildlife conservation and has a vision to 'secure a shared future for wildlife and people'. To achieve this, they are utilizing research in the field of pro-conservation behavior change in creating transformational experiences that encourage and empower their 1.7 million annual visitors to make better choices, champion causes, and change behaviors to deliver positive outcomes for wildlife. These objectives also align with the work of the IUCN Commission on Education and Communication (CEC), who suggest that effective communication is fundamental to the success of biodiversity conservation, and challenges 'traditional' ways of communicating biodiversity messages (Rodríguez, 2017).

Traditionally, zoo interpretation has been heavily scientific or focused on negative messaging related to threats and extinction, often using shocking statistics and imagery. The CEC is encouraging zoo scientists to work cooperatively with communicators to take their

findings and translate them into positive and relatable messages for a wider community. Saunders (2003) argues that we need a better understanding of the human-nature experience and a more compelling langue to express what we value and love. Novacek (2008) maintains messages of environmental matters should avoid portraying issues as overly scientific, immersed in controversy, or detached from human interest. Instead, in the case of biodiversity, the importance of promoting species as providing ecosystem services, providing natural beauty and pleasure, and sustaining human lives are messages that have the ability to impact diverse audiences (Novacek, 2008).

A recent example of Taronga Zoo's incorporation of the IUCN environmental communication recommendations is the development of the new Sumatran Tiger exhibit and associated TigerTrek Exhibit, which is an immersive, multi-sensory experience utilizing story-telling to take visitors on a choreographed, emotive journey and encourages visitors to change their behaviour in order to help wildlife. The messaging is derived from evidence that the most common message on biodiversity, that of extinction, inspires guilt but not action, conversely 'love' messages based on awe and wonder are much more powerful at capturing visitor imagination attention (Futerra 2010; Jacobson et.al., 2018). Taronga is rewriting the narrative, using love and messages that empower visitors to believe that their choices have global impact; transitioning from messages that blame people as being the problem to messages that empower people to become part of the solution.

Study Theoretical Framework

Per McDonald (2014), most behavior change theories, related to pro-conservation behaviors, originate from the field of social psychology and can be broadly categorized into three theoretical domains: moral, rational choice, and non-rational choice. Moral theories, such as the New Environmental Paradigm (Dunlap, & Van Liere, 1978), Norm Activation Model (Liere, & Dunlap, 1978), and Value-Belief-Norm Theory (Stern, Dietz, Abel, Guagnano, & Kalof, 1999) focus narrowly on environmental values as the main driver. Rational choice theories, such as the Theory of Planned Behavior (Ajzen, 1985), focus primarily on the impact of attitudes. Non-rational choice theories, such as the Theory of Interpersonal Behavior (Triandis, 1979) and the Comprehensive Action Determination Model (Klöckner, & Blöbaum, 2010), integrate factors such as habit and emotions in order to provide partially more comprehensive frameworks, however most lack a holistic suit of factors that include predisposing factors, such as habits, along with information factors around messaging or experience.

One behavior change model which has not yet been applied to the field of environmental behavior is the Integrated Model for Behavior Change (I-Change) (Figure 2) (de Vries, Mesters, Van de Steeg, & Honing, 2005). The I-Change Model is a psychological, socio-cognitive model of behavior change derived from the Attitude – Social Influence – Self-Efficacy Model (de Vries, & Mudde, 1998) and integrates ideas of Ajzen's (1985) Theory of Planned Behavior, Bandura's (1989) Social Cognitive Theory, Prochaska's (1997) Transtheoretical Model, the Health Belief Model (Hochbaum, Rosenstock, & Kegels, 1952) and goal setting theories.

While the I-Change Model has pre-dominantly been applied to the field of human health, it may have potential in the field of pro-conservation behavior change, particularly in the context of wildlife tourism (including zoos and aquariums), due to the holistic suite of factors

incorporated into the model in a non-linear manner. The I-Change Model posits behavior is the result of one's intentions, capacities (abilities), and perceived barriers. Motivational factors, such as attitudes, values, and norms determine a person's intention to change. These motivational factors are influenced by awareness factors, such as knowledge; information factors, such as message and experience; and predisposing factors, such as prior behaviors and preconceived notions. Barriers, such as not knowing how to perform a behavior, can decrease the chance that intentions will translate into action while ability factors, such as the provision of a product labelling system, can increase the chance that intentions will translate into action.

The model is highly relevant in a zoo setting as it incorporates experiential and interpretive messaging influences as a potential driver of behavior change, which allows for the impact of components of an exhibit or campaign to be isolated, measured and incorporated into an understanding of what drives people to participate in pro-conservation behaviors. In so doing, the model facilitates analyses surrounding the extent a visitor's visit to the TigerTrek Exhibit impacted their intentions to engage in conservation behaviors. The original I-Change Model (De Vries, Reubsaet & De Nooijer, 2004) has been modified for this study (Figure 3) to better represent the system of factors influencing pro-conservation behavior change in a zoo context (Figures 1 and 2).

The I-Change Model
DeVries et al., 2004; 2005

Predisposing Factors
- Behavioral Factors
- Psychological Factors
- Biological Factors
- Social Cultural Factors

Awareness Factors
- Knowledge
- Cues to Action
- Risk Perception

Information Factors
- Message
- Channel
- Source

Motivation Factors
- Attitude: Pros & Cons Rational & Emotional
- Social Influences: Norms Modelling Pressure
- Efficacy: Routine Social Situational Stress

Ability Factors
- Action Plans
- Skills

Intention State
- Precontemplation
- Contemplation
- Preparation

Behaviour State
- Trial
- Maintenance

Barriers

Figure 2. The original Integrated Model of Behavior Change

The I-Change Model
(modified)

Predisposing Factors
- Demographics
- Preconceived Notions
- Prior Behaviours

Awareness Factors
- Knowledge

Information Factors
- Message
- Experience
- Satisfaction

Motivation Factors
- Attitude
- Values

Ability Factors

Intention State

Behaviour State
- On-Site
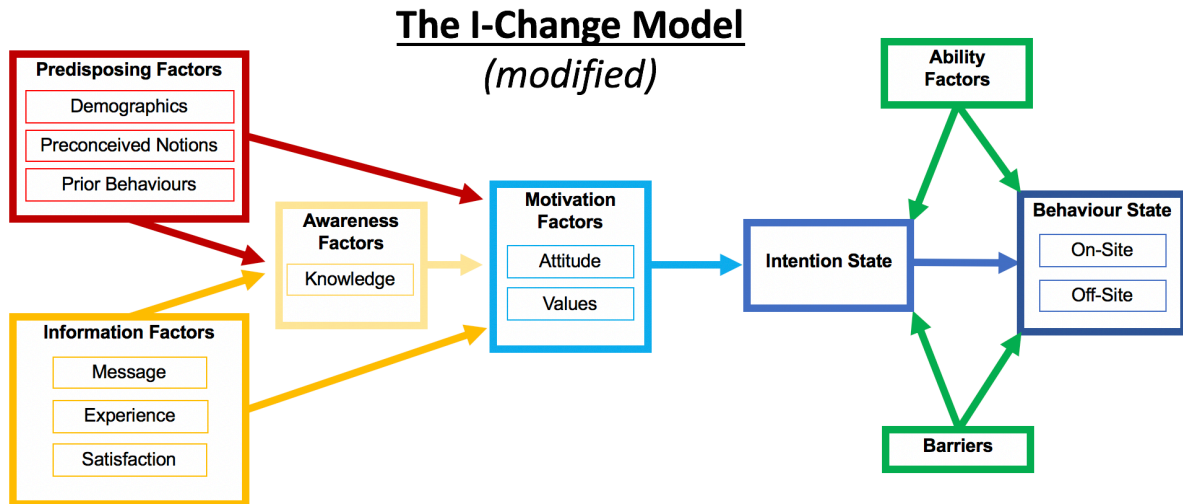- Off-Site

Barriers

Figure 3. The modified Integrated Model of Behavior Change

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Study Site

Taronga Zoo, located in Sydney, Australia has a current annual visitation of 1.93 million visitors per year. Founded in 1916, the 69-acre zoo is home to over 4,000 animals of 350 species and is a not-for-profit organisation (TCSA, 2017). Taronga has strong *in-situ* breeding programs for many endangered species and is heavily involved in *ex-situ* conservation through partnerships and field grants. Taronga is also home to the largest zoo-based conservation science team in Australia and has just opened a new Institute of Science and Learning; 'a living laboratory for conservation education and scientific investigation, built to empower the scientists of tomorrow'.

The new TigerTrek exhibit, an Indonesian-themed experience, provides an opportunity for visitors to get up-close with critically endangered Sumatran Tigers and become immersed in the issues surrounding tiger conservation. Throughout the exhibit, visitors are encouraged to download the Taronga App to their mobile device(s) and complete the Wild Squad TigerTrek Mission, which is an interactive game utilizing 4 'clues' hidden around the exhibit. Visitors begin their tightly-choreographed journey as they board a virtual-reality simulated flight to Sumatra and arrive in the recreated village of Way Kambas National Park. As visitors explore the village, they are reminded of the clues in the app. Visitors who use the clues to get all 4 challenges correct win the TigerTrek badge.

After moving through the three tiger exhibits, visitors exit through ChoiceMart; a supermarket simulation where they discover how we all have a role to play in saving tigers from extinction, by choosing Certified Sustainable Palm Oil. Visitors can use the Taronga App on their phone to scan QR codes on the interprative signs within ChoiceMart or use the interactive digital screens to explore the supermarket simulation to see if common grocery products contain

sustainably sourced palm oil. Visitors also have the option to send pre-written emails to companies to express their support for the use of certified sustainable palm oil.

Research Objectives

The objectives of this study are to utilize the I-Change Model to identify and quantify the influence of predisposing, information, awareness, motivation, and ability factors, and barriers on visitors' pro-conservation behavioral intentions and behaviors following a visit to the Tiger Trek exhibit.

Methods

Survey Instrument Development

Survey instruments were developed and modified following the tailored design method and DeVellis (2003). Surveys were designed to have an average completion time of ten minutes or less, and to be self-administered. Pre- and post-visit survey versions were developed, as well as a modified longitudinal follow up survey that was administered via email at six-weeks and six-months post visit. A pilot test (N = 100, 71% response rate) was conducted at Taronga Zoo in November 2017 to identify construct validity and item clarity issues.

Survey Instrument Administration

The participants of this study were visitors at Taronga Zoo between December 2017 - January 2018. This time frame was chosen to coincide with the opening of the exhibit and to collect responses from both weekday and weekend days. Survey administration occurred from 10am until 4pm between the 15th, of December 2017 and the 5th of January 2018.

Survey administration utilized census sampling. Visitors were intercepted upon entry into the Seal Show Theatre and Bird Show Theatre and asked if they had visited the TigerTrek exhibit to ascertain pre- or post-visit instrument provision. Show theatres were chosen as survey

administration points as all visitors had to pass through a designated entry which provided an opportunity to engage with every visitor as they passed through, and visitors had the opportunity to sit in the theatre and complete the survey while waiting for the shows to start.

Independent samples of pre-visit ($n = 514$, 70% response rate) and post-visit ($n = 609$, 74% response rate) visitors were asked to complete the respective survey instrument. All visitors who competed either the pre- or post-visit survey were asked to provide their email address to receive follow-up surveys. A total of 369 email addresses (32.9% response rate) were collected. and these were contacted via email using Qualtrics software at six-weeks (total responses $n = 106$, 10.1% response rate) and six-months post visit (total responses, $n = 24$, 2.3% response rate) with a qualifying question to ensure participating guests visited the TigerTrek exhibit during their zoo visit.

Variables (see Figure 2)

Independent Variables:

Predisposing Factors

- Demographics: (Table 1) Visitors' age, gender, level of education, residence, and membership to Taronga and/or another conservation organizations.

- Prior Behavior: (Table 2, Figure 4) This variable measured visitors' prior pro-conservation behavioral habits. Seven items on a 5-point Likert scale and one categorical item assessed activity levels around pro-conservation behaviors.

- Preconceived Notions: (Table 3, Figure 5) This variable measured visitor's preconceived notions around palm oil sustainability and consisted of two yes/no items.

Information Factors:

- Satisfaction: (Table 4, Table 5, Figure 6) This variable measured visitors' levels of satisfaction with their tiger viewing experience and overall exhibit experience. 2 items on a 5-point likert scale and 1 categorical item assessed actual tiger viewing experience as well as satisfaction ratings.

- Experience: (Table 6) This variable measured visitors' actual levels of engagement with the interactive components of the exhibit interpretation and consisted of four yes/no items.

Awareness Factors

- Knowledge: (Table 7) This variable measured visitors' levels of awareness of issues related to the threats facing Sumatran Tigers using 1 item on a 5-point likert type scale as well as 2 items on a yes/no scale.

Motivation Factors

- Values: (Table 8) This variable measured visitors' values as they relate to personal and societal responsibility for wildlife conservation. 6 items on a 5-point likert scale assessed visitors' wildlife conservation values.

- Attitudes: (Table 8) This variable measured visitors' attitude towards issues of Sumatran Tiger conservation, wildlife protection, and consumer decisions, using 6 items on a 5-point Likert type scale.

Barriers

- Barriers: (Table 9) This variable measured visitors' discernment of a range of potential barriers that could hinder their ability to perform the on-site or off-site behaviors, measured using 7 items on a 5-point likert type scale.

Dependent Variables:

Behavior Intention

- Behavior Intention: (Table 10) This variable measured visitors' self-reported intention to participate in off-site pro-conservation behaviors, grouped into personal, political, financial and consumer behaviors and measured using 14 items on a 5-point Likert type scale (consumer behavior = 4 items, personal behavior = 4 items, financial behavior = 3 items, political behavior = 3 items).

On-site Behavior

- On-site Behavior: (Table 6) This variable measured visitors' participation in the on-site behavior of sending an email to companies from the ChoiceMart exhibit, measured using 1 item on a yes/no scale.

Off-site Behavior

- Off-site Behavior: (Table 13) This variable was only measured during the longitudinal follow-up survey email using 16 items, on a yes/no scale. Items were developed based on the behavior intention items and asked for self-reported data on actual execution of off-site pro-conservation behaviors, grouped into personal (4 items), political (3 items), financial (3 items) and consumer behaviors (6 items).

Analysis

Data were screened for missing values. Cases exhibiting missing values for more than 50% of items per factor were removed (Schafer & Graham, 2002). A total of 26 cases were removed. Data were screened for univariate outliers (± 3 S.D.). One post-visit case was removed. Finally, data were screened for multivariate outliers and a total of 21 pre-visit cases and 26 post-visit cases were removed for exceeding the criterion Mahalanobis Distance value ($\chi^2 = 16.27$, df $= 2$, $p < .001$). The final sample size was n = 1049 ($n = 486$ pre-visit; $n = 563$ post-visit). SPSS software (v25) was used to generate descriptive data, and univariate and multivariate analyses.

Results

Predisposing Factors

Demographics:

The sample, with a total sample size of 1047, had the following demographics: Mean age of 38 years old; 38.5% (397) male, 61.5% (633) female; 57.3% (582) reported completing at least an undergraduate degree; 76.8% (785) reside in Australia; and 28.3% (296) reported to be a member of Taronga Zoo (ZooFriends) or any other zoo or conservation organisation.

Pre and post visit groups had the same mean age and level of education, however the post visit group had a higher percentage of females (62.3% (354), compared to 58% (279) pre-visit), higher percentage of participants who reside in Australia (79.2% (450) compared to 69.9% (335) pre-visit) and a higher percentage of participants who reported to be a member of Taronga Zoo (ZooFriends) or any other zoo or conservation organisation (35.6% (202) compared to 19.6% (94) pre-visit).

Table 1. Predisposing Factors: Demographics.

Demographic	Category		*n* (%)
Gender	Male		397 (38.5%)
	Female		633 (61.5%)
		Total	**1030 (100%)**
Age	18-38		205 (20.9%)
	38-48		265 (27%)
	48-58		239 (24.4%)
	>58		271 (27.7%)
		Total	**980 (100%)**
Education	Y1-10		97 (9.5%)
	Y11-12		152 (15%)
	Cert/Diploma		184 (18.1%)
	Undergrad		268 (26.4%)
	Postgrad		314 (30.9%)
		Total	**1015 (100%)**
ZooFriends Member	Yes		220 (21.4%)
	No		808 (78.6%)
		Total	**1047 (100%)**
Member of ZooFriends or any other conservation organisation	Yes		296 (28.3%)
	No		751 (71.7%)
		Total	**1047 (100%)**
Location	Australia		785 (76.8%)
	International		237 (23.2%)
		Total	**1022 (100%)**

Prior Behaviors:

To assess prior behaviors, all respondents were asked "Which statement best reflects your shopping habits in the past" Of the 1015 respondents, 41.4% (440) selected 'palm oil was not a consideration in their purchasing decisions', 31.9% (324) selected 'I try to avoid buying products that contain any palm oil', 19.8% (201) selected, 'I sometimes choose products because they contained sustainable palm oil', and 6.9% (70) selected, 'I always choose products because they contain sustainable palm oil'.

Prior Purchasing Behavior

- Palm oil is not a consideration
- Avoid products containing palm oil
- Sometimes buy sustainable palm oil
- Always buy sustainable palm oil

Figure 4. Prior palm oil purchasing behavior.

Table 2. Predisposing Factors: Prior Behavior.

Prior Behavior	Category	*n* (%)
Which statement best reflects your shopping habits in the past	Palm oil is not a consideration in my purchasing decisions	440 (41.4%)
	I sometimes choose products because they contain sustainable palm oil	201 (19.8%)
	I always choose products because they contain sustainable palm oil	70 (6.9%)
	I try to avoid buying products that contain any palm oil	324 (31.9%)
	Total	**1015 (100%)**

Notes. Visitors were asked to select only one answer.

Preconceived Notions:

To assess preconceived notions, all respondents were asked to answer yes or no to: "Do you have concerns that SOME palm oil is grown unsustainably" and "Do you have concerns that ALL palm oil is grown unsustainably". Pre-visit visitors were treated as baseline data. Of the 471 respondents, 50.3% (234) reported "yes" for concern that ALL palm oil is grown unsustainably and 79% (372) reported "yes" for concern that SOME palm oil is grown unsustainably. From a sample size of 557, the number of post-visit visitors who reported "yes" for concern that SOME palm oil is grown unsustainably showed a significant increase to 84.6% (471) ($\chi^2 = 5.38$ (1), $p < .05$), and the number of post-visit visitors who reported "yes" for concern that ALL palm oil is grown unsustainably showed a significant increase, up to 60% (331) ($\chi^2 = 9.09$ (1), $p < .01$).
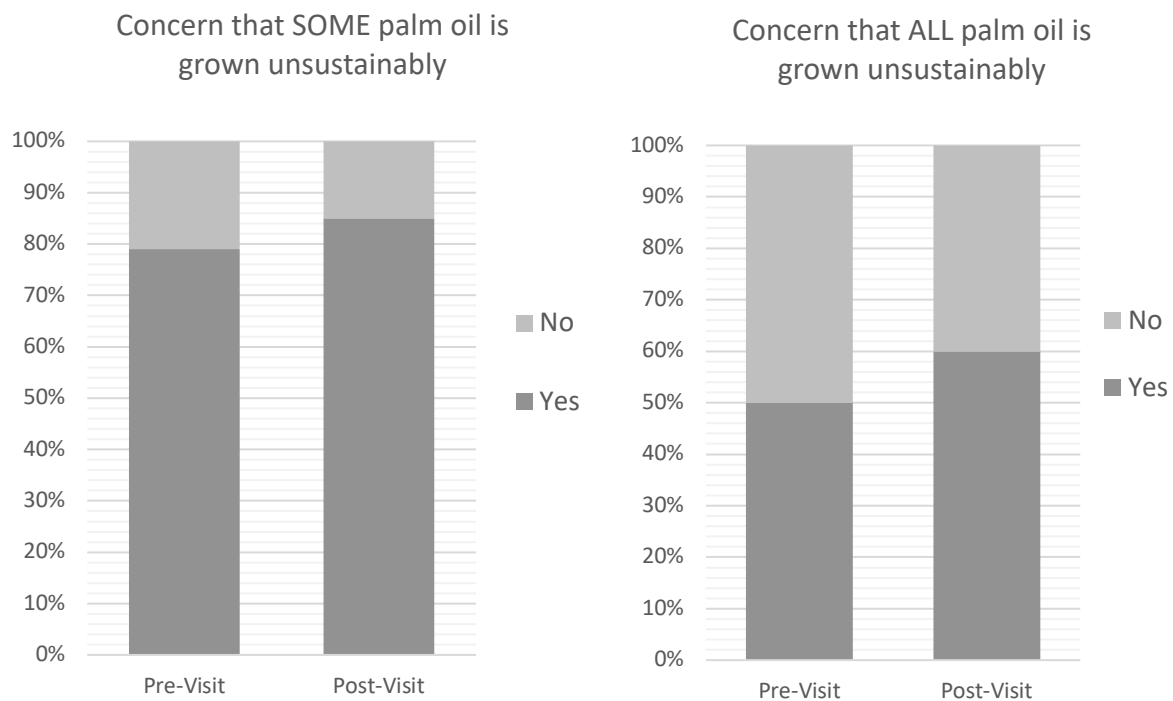
Figure 5. Preconceived Notions.

Table 3. Predisposing Factors: Preconceived Notions.

Preconceived Notions		Pre-visit n (%)	Post-visit n (%)	χ^2 (df)*
Concerns that SOME palm oil is grown unsustainably	Yes	372 (79.0%)	471 (84.6%)	5.38 (1), $p < .05$
	No	99 (21.0%)	86 (15.4%)	
	Total	**471 (100%)**	**557 (100%)**	
Concerns that ALL palm oil is grown unsustainably	Yes	234 (50.3%)	331 (60%)	9.09 (1), $p < .01$
	No	231 (49.7%)	223 (40%)	
	Total	**465 (100%)**	**554 (100%)**	

Notes. *χ^2 = Chi-Square Test of Independence; df = degrees of freedom

Information Factors

Satisfaction

To assess visitor's levels of engagement with the interactive components of the exhibit interpretation, the post-visit respondents were asked to classify their tiger viewing experience into one of four categories. Of the 556 respondents, only 4.1% (23) reported not seeing a tiger, 18% (100) only saw a tiger in the distance, 35.4% (197) had a good view of a tiger and 42.4% (236) had an incredible view of a tiger. They were also asked to rate their overall exhibit satisfaction and tiger viewing satisfaction on a 5-point face scale of mood, with a mean of 4.32 (± 0.79 S.D.) for overall exhibit satisfaction and 4.20 (± 1.00 S.D.) for tiger viewing satisfaction.
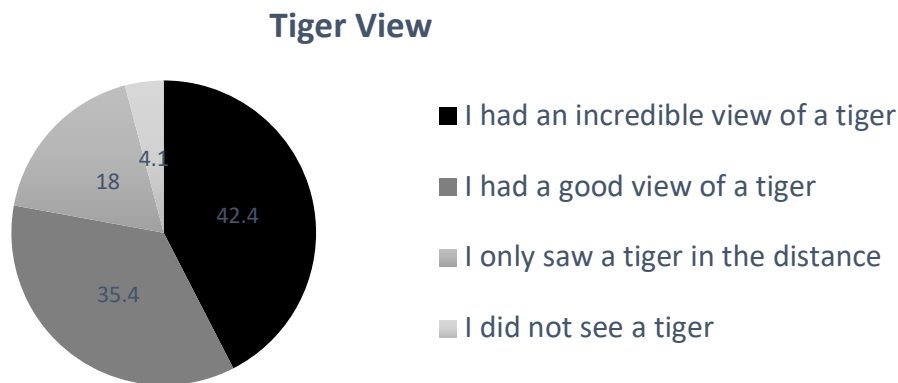
Figure 6. Tiger View

Table 4. Information Factors: Tiger View.

Experience	Category	n (%)
Which statement best reflects your Tiger viewing experience?	I did not see a tiger	23 (4.1%)
	Only saw a tiger in the distance	100 (18%)
	I had a good view of a tiger	197 (35.4%)
	I had an incredible view of a tiger	236 (42.4%)
	Total	**556 (100%)**

Table 5. Information Factors: Satisfaction.

Satisfaction*	Category	n (%)
Satisfaction with overall exhibit experience	1	4 (0.7%)
	2	11 (2%)
	3	54 (9.7%)
	4	219 (39.5%)
	5	267 (48.1%)
	Total	**555 (100%)**
Satisfaction with tiger viewing experience	1	14 (2.5%)
	2	28 (5%)
	3	64 (11.5%)
	4	178 (32.1%)
	5	271 (48.8%)
	Total	**555 (100%)**

Notes. * Rated on a 5-point scale (1 = strongly dissatisfied, 5 = strongly satisfied)

Experience:

Post-visit visitors were also asked a series of yes/no questions related to their use of the Taronga app and the interactive screens inside the ChoiceMart section of the exhibit. 29.4% (149) reported downloading the Taronga app, with only 9.9% (56) using the WildSquad Tiger Mission on the app and 10.3% (58) using the app to scan the QR codes inside ChoiceMart. 37.8% (213) of post-visit visitors reported using the interactive screens inside the ChoiceMart, with 23.1% (130) using either the screens or the app to send an email to companies through the ChoiceMart platform.

Table 6. Information Factors: Experience.

Experience	Category		n (%)
Did you download the Taronga app?	Yes		149 (29.4%)
	No		359 (70.6)
		Total	508 (100%)
Did you use the Wild Squad Tiger Mission on the Taronga app?	Yes		56 (9.9%)
	No		507 (90.1%)
		Total	563 (100%)
Did you use the Taronga app to scan QR codes in ChoiceMart?	Yes		58 (10.3%)
	No		505 (89.7%)
		Total	563 (100%)
Did you interact with the screens in ChoiceMart?	Yes		213 (37.8%)
	No		350 (62.2%)
		Total	563 (100%)
Did you email companies from ChoiceMart?	Yes		130 (23.1%)
	No		433 (76.9%)
		Total	563 (100%)

Awareness Factors

All respondents were asked 3 items to measure knowledge of issues associated with Sumatran Tiger conservation. There was a significant increase in correct answers between pre-visit (n = 479) and post-visit (n = 568) groups for all three items, with correct knowledge of how many Sumatran Tigers are left in the wild increasing from 53% (254) pre-visit to 70% (397) post visit (χ^2 = 31.44 (1), p < .001), correct knowledge of the conservation status of tigers (critically endangered) increasing from 48.2% (231) pre-visit to 59.5% (338) post visit (χ^2 = 13.33 (1), p < .001) and understanding of the fact that unsustainable palm oil plantations are destroying the habitats of Sumatran Tigers increasing from 51.1% (245) pre-visit to 75.2% (427) post visit (χ^2 = 65.26 (1), p < .001).

Table 7. Awareness Factors: Knowledge.

Factor and Items		Pre-visit n (%)	Post-visit n (%)	χ^2 (df)*
How many Sumatran Tigers are	Correct	254 (53%)	397 (70%)	31.44 (1), p < .001
there in the wild?	Incorrect	225 (47%)	171 (30%)	
	Total	**479 (100%)**	**568 (100%)**	
What is the conservation status	Correct	231 (48.2%)	338 (59.5)	13.33 (1), p < .001
of Sumatran Tigers?	Incorrect	248 (51.8%)	230 (40.5)	
	Total	**479 (100%)**	**568 (100%)**	
Unsustainable palm oil	Correct	245 (51.1%)	427 (75.2%)	65.26 (1), p < .001
plantations are destroying the	Incorrect	234 (48.9%)	141 (24.8%)	
habitats of Sumatran Tigers	**Total**	**479 (100%)**	**568 (100%)**	

Notes. *$\chi2$ = Chi-Square Test of Independence; df = degrees of freedom

Motivation Factors

All visitors were asked 12 questions to measure their values and attitudes towards issues of environmental protection and Sumatran Tiger conservation, both as they relate to their personal responsibility towards these issues and how they view society's responsibility for these issues. Questions were measured on a 5-point likert type scale from 1=strongly disagree to 5=strongly agree from a total pre-visit sample size of 479 and post-visit sample size of 565.

There were significant increases between the pre-visit group and post-visit group for 'ensuring Sumatran Tigers' survival is my highest priority' which increased from a mean of 3.38 (± 1.11 S.D.) to 3.83 (± 1.03 S.D.) (t = -6.976 (1029), $p < .000$); 'I am willing to alter my lifestyle to protect Sumatran Tigers' which increased from a mean of 3.92 (± 0.94 S.D.) to 4.19 (± 0.81 S.D.) (t = -4.913 (1037), $p < .000$); and 'buying ethical & sustainable products is important to me' which increased from a mean of 4.02 (± 0.81 S.D.) to 4.24 (± 0.86 S.D.) (t = -4.252 (1033), $p < .000$). The only item to decrease between the pre-visit and post-visit groups was "Sumatran Tigers have as much right to exist as any human" which decreased from a mean of 4.68 (± 0.69 S.D.) to 4.51 (± 0.89 S.D.) (t = 3.237 (1038), $p < .001$).

Table 8. Motivation Factors: Values.

Factors and items	Pre-visit (n = 479) Mean (±S.D.)*	Post-visit (n = 565) Mean (±S.D.)*	$t(df)$*
Personal responsibility for conservation			
I am willing to alter my lifestyle to protect Sumatran Tigers	3.92 (± 0.94)	4.19 (± 0.81)	-4.913 (1037), $p < .000$
Buying ethical & sustainable products is important to me	4.02 (± 0.81)	4.24 (± 0.86)	-4.252 (1033), $p < .000$
I believe my consumer choices have global impact	4.36 (± 0.72)	4.41 (± 0.79)	NS
It's up to us as consumers to use our purchasing power to encourage retail stores to only sell sustainable and ethical products	4.35 (± 0.77)	4.45 (± 0.74)	-2.166 (1041), $p < .05$
Ensuring Sumatran Tigers' survival is my highest priority	3.38 (± 1.11)	3.84 (± 1.03)	-6.976 (1029), $p < .000$
Societal responsibility for conservation			
Wildlife protection must be societies' highest priority	4.00 (± 0.97)	4.31 (± 0.84)	-5.403 (1029), $p < .000$
Sumatran Tigers have as much right to exist as any human	4.68 (± 0.69)	4.51 (± 0.89)	3.237 (1038), $p < .001$
It is humans' job to protect Sumatran Tigers from extinction	4.51 (± 0.69)	4.54 (± 0.68)	NS
It's up to governments and regulators to ensure products are ethically produced	4.16 (± 0.87)	4.18 (± 0.95)	NS
It's up to suppliers and retailers to ensure products are ethically produced	4.17 (± 0.87)	4.27 (± 0.89)	NS

Notes. *t = t-test for equality of means; df = degrees of freedom; S.D. = Standard Deviation.

Rated as agreement on a 5-point scale (1 = strongly disagree, 5 = strongly agree)

Barriers

To assess visitor's discernment of potential barriers to performing on-site or off-site behaviors, all respondents were asked 7 items. From a pre-visit sample size of 479 and a post-visit sample size of 565, the barrier that was rated highest on a 5-point scale from 1= strongly disagree to 5 = strongly agree was 'I do not feel comfortable providing companies with my personal contact details' with a pre-visit mean of 3.87 (± 1.09 S.D.) decreasing to a post-visit mean of 3.66 (± 1.15 S.D.) (t = 3.006 (1037), $p < .01$) followed by 'I want to support tiger conservation, but I do not know how' with a pre-visit mean of 3.79 (± 0.89 S.D.) decreasing to a post-visit mean of 3.61 (± 0.97 S.D.) (t = 3.161 (1044), $p < .01$).

Two items that relate to trust in the idea of sustainably sourced palm oil also rated above neutral; 'I do not trust companies' claims that their palm oil comes from sustainable sources' with a pre-visit mean of 3.56 (± 0.96 S.D.) and a post-visit mean of 3.52 (± 0.95 S.D.) and 'I think all palm oil is bad and that it should be boycotted' with a pre-visit mean of 3.54 (± 1.00 S.D.) and a post-visit mean of 3.54 (± 1.11 S.D.), however both of these had non-significant differences between pre and post-visit groups. .

Table 9. Barriers

Factor and Items	Pre-visit (*n* = 479) Mean (±S.D.)*	Post-visit (*n* = 565) Mean (±S.D.)*	*t* (*df*)*
I want to support tiger conservation, but I do not know how	3.79 (± 0.89)	3.61 (± 0.97)	3.161 (1044), *p* < .01
I do not know how to identify products that contain Sustainable Palm Oil	3.55 (± 1.09)	3.40 (± 1.18)	2.174 (1028), *p* < .05
I think all palm oil is bad and that it should be boycotted	3.54 (± 1.00)	3.54 (± 1.11)	NS
I do not believe palm oil can be sustainable	3.22 (± 0.88)	3.07 (± 1.09)	2.545 (1035), *p* < .05
I do not trust companies claims that their palm oil comes from sustainable sources	3.56 (± 0.96)	3.52 (± 0.95)	NS
I do not feel comfortable providing companies with my personal contact details	3.87 (± 1.09)	3.66 (± 1.15)	3.006 (1037), *p* < .01
I do not think companies will listen to emails sent through ChoiceMart	-	3.33 (± 1.07)	-

Notes. *t = t-test for equality of means; *df* = degrees of freedom; S.D. = Standard Deviation

Rated as agreement on a 5-point scale (1 = strongly disagree, 5 = strongly agree)

Behavior Intention

To assess visitor's intention to engage in pro-conservation actions upon leaving the zoo, all respondents were asked 14 items rated on a 5-point likert scale with 1 = extremely unlikely to 5 = extremely likely, with a pre-visit sample size of 479 and a post-visit sample size of 567.

The behavior that visitors reported to be most likely to engage in was 'I will only purchase products with Certified Sustainable Palm Oil' with a pre-visit mean of 3.54 (± 1.03 S.D.) increasing to a post-visit mean of 3.79 (± 1.04 S.D.) ($t = -3.925$ (1035), $p < .000$), followed by 'even when they are more expensive, I will only buy products that support wildlife' with a pre-visit mean of 3.51 (± 1.13 S.D.) increasing to a post-visit mean of 3.68 (± 1.08 S.D.) ($t = -2.506$ (1041), $p < .05$) and then 'I will change my diet to support environmental protection' with a pre-visit mean of 3.51 (± 1.19 S.D.) increasing to a post-visit mean of 3.65 (± 1.10 S.D.) ($t = -1.972$ (1038), $p < .05$).

The behavior that visitors reported to be least likely to engage in was 'I will organise a fundraiser for Taronga's conservation projects' with a pre-visit mean of 2.11 (± 1.00 S.D.) increasing to a post-visit mean of 2.36 (± 1.17 S.D.) ($t = -3.712$ (1042), $p < .000$), followed by 'I will make a monthly donation for Taronga's conservation projects' with a pre-visit mean of 2.00 (± 1.08 S.D.) increasing to a post-visit mean of 2.50 (± 1.20 S.D.) ($t = -3.165$ (1037), $p < .01$) and then 'I will contact a member of parliament to ask for action' with a pre-visit mean of 2.00 (± 1.12 S.D.) increasing to a post-visit mean of 2.53 (± 1.24 S.D.) ($t = -3.916$ (1038), $p < .000$).

Table 10. Behavior Intention

Factors and items	Pre-visit (*n* = 479) Mean (±S.D.)*	Post-visit (*n* = 567) Mean (±S.D.)*	$t\,(df)$*
Consumer Behavior			
I will do my own research to avoid buying products that are not sustainably produced	3.33 (± 1.17)	3.55 (± 1.13)	-3.079 (1041), $p < .01$
I will only purchase products with Certified Sustainable Palm Oil	3.54 (± 1.03)	3.79 (± 1.04)	-3.925 (1035), $p < .000$
Even when they are more expensive, I will only buy products that support wildlife	3.51 (± 1.13)	3.68 (± 1.08)	-2.506 (1041), $p < .05$
I will change my diet to support environmental protection	3.51 (± 1.19)	3.65 (± 1.10)	-1.972 (1038), $p < .05$
Financial Behavior			
I will organise a fundraiser for Taronga's conservation projects	2.11 (± 1.00)	2.36 (± 1.17)	-3.712 (1042), $p < .000$
I will become a Taronga Zoo Parent by 'adopting' a Sumatra Tiger	2.45 (± 1.18)	2.71 (± 1.25)	-3.429 (1040), $p < .001$
I will make a monthly donation for Taronga's conservation projects	2.00 (± 1.08)	2.50 (± 1.20)	-3.165 (1037), $p < .01$
Personal Behavior			
I will use social media to help raise awareness	3.00 (± 1.29)	3.04 (± 1.30)	-2.160 (1041), $p < .05$
I will speak to family or friends to help raise awareness	3.39 (± 1.22)	3.61 (± 1.14)	-3.021 (1038), $p < .01$
I will contact a company to ask for action	2.00 (± 1.15)	2.78 (± 1.28)	-5.256 (1042), $p < .000$
I will volunteer for a wildlife conservation organization	2.77 (± 1.23)	2.77 (± 1.30)	NS

Factors and items	Pre-visit	Post-visit	$t (df)^*$
	$(n = 479)$	$(n = 567)$	
	Mean (±S.D.)*	Mean (±S.D.)*	
Political Behavior			
I will contact a member of parliament to ask for action	2.00 (± 1.12)	2.53 (± 1.24)	-3.916 (1038), $p < .000$
Environmental issues will be my top priority in government voting	3.01 (± 1.27)	3.23 (± 1.25)	-2.790 (1040), $p < .01$
I will join a march/protest/rally for environmental action	2.46 (± 1.25)	3.00 (± 1.28)	-2.174 (1045), $p < .05$

Note. $^*t$ = t-test for equality of means; df = degrees of freedom; S.D. = Standard Deviation

Rated as agreement on a 5-point scale (1 = strongly disagree, 5 = strongly agree)

Behavior

Post-visit visitors who said they are a member of ZooFriends or any other zoo or conservation organisation ($n = 296$) were 2.37 times more likely to engage in the on-site behavior of emailing companies from the ChoiceMart section of the exhibit ($p < .000$) (logistic regression model $\chi^2(1) = 17.93$, $p < .000$) compared to guests who were not ($n = 751$).

Post-visit visitors who said they felt concerned that some palm oil was grown unsustainably ($n = 471$) were 3.85 times more likely to report an intention to engage in the desired off-site behavior of only purchasing products with Certified Sustainable Palm Oil ($p < .000$) (logistic regression model $\chi^2(1) = 17.91$, $p < .000$) compared to guests who did not ($n = 86$).

Post-visit visitors who selected an overall exhibit satisfaction rating of 5 ($n = 267$) were 2.19 times more likely to engage in the on-site behavior of emailing companies from the ChoiceMart section of the exhibit ($p < .000$) (logistic regression model $\chi^2(5) = 38.27$, $p < .000$) compared to guests who selected a rating of 4 or less ($n = 288$), however there was no

statistically significant relationship between tiger viewing experience or tiger viewing satisfaction and either the on-site or off-site dependent variables.

Post-visit visitors who used the Taronga app to scan the QR codes in ChoiceMart (n = 58) were 15.33 times more likely to engage in the on-site behavior of emailing companies from the ChoiceMart section of the exhibit ($p < .000$) (logistic regression model $\chi^2(1) = 69.16$, $p < .000$) compared to guests who did not ($n = 505$) and visitors who interacted with the digital screens in ChoiceMart ($n = 213$) were 36.56 times more likely to engage in the on-site behavior of emailing companies from the ChoiceMart section of the exhibit ($p < .000$) (logistic regression model $\chi^2(1) = 198.26$, $p < .000$) compared to guests who did not ($n = 350$).

Those post-visit visitors who correctly identified that unsustainable palm oil plantations are destroying the habitats of Sumatran Tigers ($n = 427$) were 4.25 times more likely to report an intention to engage in the desired off-site behavior of only purchasing products with Certified Sustainable Palm Oil ($p < .000$) (logistic regression model $\chi^2(3) = 33.08$, $p < .000$) compared to those who answered incorrectly ($n = 141$), however there was no statistically significant relationship between knowledge of Sumatran Tiger population or status and either the on-site or off-site dependent variables.

Visitors who strongly agreed that ensuring Sumatran Tigers' survival was their highest priority ($n = 167$) were 1.81 times more likely to engage in the on-site behavior of emailing companies from the ChoiceMart section of the exhibit compared to those who did not ($n = 385$) ($p < .01$) while visitors who strongly agreed that wildlife protection must be societies' highest priority ($n = 279$) were 1.52 times less likely to take the personal action of emailing companies from the ChoiceMart section of the exhibit compared to those who did not ($n = 278$) ($p < .05$), (logistic regression model $\chi^2(12) = 30.98$, $p < .01$)

Additionally, visitors who strongly agreed that Sumatran Tigers have as much right to exist as any human (n = 393) were 1.47 times more likely to report an intention to engage in the desired off-site behavior of only purchasing products with Certified Sustainable Palm Oil compared to those who did not (n = 165), (p < .05), (logistic regression model $\chi^2(3)$ = 33.08, p < .000) and visitors who strongly agreed that they were willing to alter their lifestyle to protect Sumatran Tigers (n = 225) were 2.00 times more likely to report an intention to engage in the desired off-site behavior of only purchasing products with Certified Sustainable Palm Oil compared to those who did not (n = 333), (p < .01), (logistic regression model $\chi^2(12)$ = 80.31, p < .000).

Visitors who strongly agreed that they "do not think companies will listen to emails sent through ChoiceMart" (n = 86) were 1.25 times less likely to engage in the on-site behavior of emailing companies from the ChoiceMart section of the exhibit compared to those who did not (n = 472), (p < .05) and visitors who did not feel comfortable providing companies with their personal contact details (n = 157) were 1.30 times less likely to email companies from the ChoiceMart section of the exhibit compared to those who did not (n = 398), (p < .01), (logistic regression model $\chi^2(7)$ = 19.60, p < .01).

Table 11. Logistic Regression: On-site Behavior.

Logistic Regression	Model			Variables in the Equation			
Predictor	$\chi^2(df)^a$	R^{2b}	Sig.	B^c	S.E.^{d}	Exp(B)^e	Sig.
Member of Taronga Zoo Friends or any other conservation organisation	17.93 (1)	.047	*p < .000*	0.86	.204	2.37	*p < .000*
Used the Taronga app to scan QR codes in ChoiceMart	69.16 (1)	.339	*p < .000*	2.73	.361	15.33	*p < .000*
Interacted with the screens in ChoiceMart	198.26 (1)	.471	*p < .000*	3.60	.350	36.56	*p < .000*
Highly satisfied with overall exhibit experience	38.27 (5)	.102	*p < .000*	0.79	.215	2.19	*p < .000*
Highly satisfied with tiger viewing experience						NS	
Ensuring Sumatran Tigers' survival is my highest priority	30.98 (12)	.091	*p < .01*	0.59	.173	1.81	*p < .01*
Wildlife protection must be societies' highest priority				-0.42	.205	0.66	*p < .05*
Do not think companies will listen to emails sent through ChoiceMart	19.60 (7)	.055	*p < .01*	-0.22	.110	0.80	*p < .05*
Do not feel comfortable providing companies with my personal contact details				-0.26	.134	0.77	*p < .01*

Notes. The dependent variable in this analysis is the on-site behavior: Email companies from ChoiceMart, coded so that 1 = sent an email and 0 = did not send an email; $^a\chi2$ = Chi-Square Test of Independence; df = degrees of freedom; ^{b}Nagelkerke R2; ^{c}B = log-odds units; ^{d}S.E. = Standard Error; ^{e}Odds ratios for the predictors

Table 12. Logistic Regression: Off-site Behavior.

Logistic Regression	Model			Variables in the equation			
Predictor	$\chi^2(df)^a$	R^{2b}	Sig.	B^c	$S.E.^d$	$Exp(B)^e$	Sig.
Have concerns that SOME palm oil is grown unsustainably	17.91 (1)	.046	*p < .000*	1.35	.357	3.85	*p < .000*
Unsustainable palm oil plantations are destroying the habitats of Sumatran Tigers	33.08 (3)	.085	*p < .000*	1.45	.306	4.25	*p < .000*
How many Sumatran Tigers are there in the wild?						NS	
What is the conservation status of Sumatran Tigers?						NS	
Sumatran Tigers have as much right to exist as any human	80.31 (12)	.216	*p < .000*	0.39	.186	1.47	*p < .05*
I am willing to alter my lifestyle to protect Sumatran Tigers				0.69	.239	2.00	*p < .01*
Do not know how to identify products that contain Sustainable Palm Oil	20.87 (7)	.056	*p < .01*	-2.41	.091	0.79	*p < .01*

Notes. The dependent variable in this analysis is the off-site behavior: Intention to only purchase products with Certified Sustainable Palm Oil, coded so that 1 = extremely likely and 0 = all other options. [a]χ^2 = Chi-Square Test of Independence; *df* = degrees of freedom; [b]Nagelkerke R^2; [c]B = log-odds units; [d]S.E. = Standard Error; [e]Odds ratios for the predictors.

Behavior conducted off-site post-visit

All respondents were asked to provide their email address if they were willing to receive follow up surveys via email. A total of 369 respondents (response rate 32.86%), across both pre- and post-visit respondents, provided email addresses. The 6-week post-visit follow up email resulted in 106 responses (response rate 28.7%) and the 6-month post-visit follow up email resulted in 24 responses (response rate 6.5%). Respondents were presented with 16 items and asked to select all responses they had participated in since their visit to the zoo (respondents could choose all responses- see Table 13).

The behavior that was most often performed by respondents off-site post-visit was 'avoided buying a product because it was not sustainably produced' which was engaged in 61.3% (65) of six-week respondents and 70.8% (17) of six-month respondents, followed by 'avoided buying a product because it contained palm oil (regardless of whether it was sustainably sourced)' which was engaged in 50% (53) of six-week respondents and 33.3% (8) of six-month respondents and then 'purchased a product that support wildlife, even though it was more expensive' and 'spoke to family or friends to help raise awareness for Tiger conservation' which were both engaged in by 45.3% (48) of six-week respondents and 45.8% (11) and 37.5% (9) of six-month respondents respectively.

The behavior which was least often engaged in were 'became a ZooParent by 'adopting' a Sumatra Tiger' and 'made a monthly donation for Taronga's conservation projects' which were not engaged in by any six-week respondents and only engaged in by one six-month respondent, followed by 'organized a fundraiser for Taronga's conservation projects' which was only engaged in by 0.9% (1) of six-week respondents and 4% (1) of six-month respondents.

Table 13. Behavior conducted off-site post-visit

Actual behavior conducted off-site*	6-weeks post visit *n* (%)	6-months post visit *n* (%)
Consumer Behavior		
Changed my diet to support environmental protection	42 (39.6%)	8 (33.3%)
Product research - to identify products that are not sustainably produced	46 (43.4%)	12 (50%)
Avoided buying a product because it was not sustainably produced	65 (61.3%)	17 (70.8%)
Purchased a product that support wildlife, even though it was more expensive	48 (45.3%)	11 (45.8%)
Purchased a product because it contained Certified Sustainable Palm Oil	31 (29.2%)	7 (29.2%)
Avoided buying a product because it contained palm oil (regardless of whether it was sustainably sourced)	53 (50%)	8 (33.3%)
Financial Behavior		
Organized a fundraiser for Taronga's conservation projects	1 (0.9%)	1 (4%)
Became a ZooParent by 'adopting' a Sumatra Tiger	0 (0%)	1 (4%)
Made a monthly donation for Taronga's conservation projects	0 (0%)	0 (0%)
Personal Behavior		
Signed up to volunteer for a wildlife conservation organisation	5 (4.7%)	1 (4%)
Used social media to help raise awareness for Tiger conservation	10 (9.4%)	6 (25%)
Spoke to family or friends to help raise awareness for Tiger conservation	48 (45.3%)	9 (37.5%)
Contacted a company to ask for environmental action	10 (9.4%)	2 (8.3%)
Political Behavior		
Joined a march/protest/rally for environmental protection	2 (1.9%)	1 (4%)
Contacted a member of parliament to ask for environmental action	5 (4.7%)	3 (12.5%)
Prioritized environmental issues in government voting	10 (9.4%)	4 (16.7%)
Total	**106 (100%)**	**24 (100%)**

Notes 'Since your visit to Taronga, have you done any of the following? (check all that apply)'

Discussion

This study explored the influence of Taronga Zoo's new TigerTrek exhibit on zoo visitor's performance of pro-conservation behaviors both on- and off-site. We sought to utilize the Integrated Model of Behavior Change to identify the relative influence of a range of factors on the ability of Taronga's Tiger Trek exhibit to engage zoo visitors. We specifically focused on Tiger Trek's influence on visitors' inclination to engage in the on-site pro-conservation behavior of contacting companies to support the use of Certified Sustainable Palm Oil and the off-site pro-conservation behavior of supporting Certified Sustainable Palm Oil as a consumer.

Anti-palm oil sentiments:

The message testing that was conducted by Taronga Zoo as part of the process of designing the TigerTrek exhibit identified that only 1 in 5 Australians believe that palm oil can be produced from sustainable sources and over 33% of Australians say that they try to avoid buying products with palm oil wherever they can. That data was supported by this study, which found that 30.28% of respondents ($n = 1037$) either agree or strongly agree with the statement 'I do not believe palm oil can be sustainable' (Table 9) and with 31.9% of respondents ($n = 1019$) reporting that in the past, they try to avoid buying products with palm oil (Table 2). These statistics most likely reflect the influence of past campaigns in Australia by animal rights groups to boycott palm oil.

One of the main objectives in the design of the interprtaive messaging for the TigerTrek exhibit was to promote the 'Raise Your Palm' campaign, which aims to 'improve consumer sentiment about palm oil and to increase pressure on companies to source and use only RSPO Certified Sustainable Palm'. The findings of this study reveal that this objective was only

partially achieved, with findings indicating that the exhibit may infact be inadvertantly decreasing consumer sentiment about palm oil.

The most significant of these findings is perhaps the longitudinal data which found that while 29.2% of respondants (at both 6-weeks and 6-months post visit) had purchased a product because it contained Certified Sustainable Palm Oil, 50% of 6-week respondents and 33.3% of 6-month respondents had avoided buying a product because it contained palm oil, regardless of whether it was sustainably sourced or not (Table 13).

A major part of the mission of the Raise Your Palm campaign is 'to ensure the RSPO trademark is legitimised and that palm oil is seen as a part of a 360 solution that will protect tigers, communities and habitat'. In order to achieve this, messaging needs to make it clear that while it is true that some palm oil is unsustainbly produced, it is not true that all palm oil is unsustainably produced.

While our results indicate that there is a statistically significant increase in the number of guests who feel concerned that SOME palm oil is grown unsustably ($\chi^2 = 5.38$ (1), $p < .05$), there is actually a stronger increase in the number of guests who feel concerned that ALL palm oil is grown unsustably ($\chi^2 = 9.09$ (1), $p < .01$) (Table 3). When it came to levels of agreement with the sentiment 'I think all palm oil is bad and that it should be boycotted', there was no significant difference between the pre-visit and post-visit means, which were both 3.54 on a 5 point scale (1 = strongly disagree and 5 = strongly agree) (Table 9). These findings justify a review of exhibit messaging, to enhance and clarify messaging aimed at building public support for sustainable palm oil.

Predictors of participation in on-site pro-conservation behavior:

When developing the TigerTrek exhbit, Taronga Zoo identified one of their goals as having '75% of all guests aware of sustainable palm oil, with a conversion rate of 20% to action'. The on-site action they chose was 'to build public support for companies to transition towards sustainable palm oil' and they facilitated this by setting up an interactive email station inside the ChoiceMart section of the exhibit to allow guests to contact companies to encourage them to transition towards 100% sustainable palm oil. This study found that 23.1% of respondants (Table 6) participated in this on-site behavior, in line with Taronga's target.

The most significant predictor of visitors performing this on-site behavior of emailing companies from the ChoiceMart section of the exhibit came from 'information factors' which included a series of items to understand visitor's interaction with the Taronga app and the interactive digital screens within the exhibit. Visitors who used the Taronga app to scan the QR codes in ChoiceMart were 15.33 times more likely to proceed to do the desired on-site behavior of emailing companies from ChoiceMart ($\chi^2 = 69.16$ (1), $p < .000$) and visitors who interacted with the digital screens were 36.56 times more likely to email companies from ChoiceMart ($\chi^2 = 198.26$ (1), $p < .000$) (Table 11). This information could justify the positioning of zoo staff or volunteers around the digital screens to further encourage interaction with the screens as this appears to be the most effective way to increase the number of emails generated.

Barriers:

Assessing the influence of barriers on pro-conservation behaviors is a novel approach in zoo conservation studies and provides the zoo with tangible feedback on issues that are prohibiting visitors from engaging in the desired pro-conservation behaviors. This study identified that 632 out of 1039 respondents agree or strongly agree that they do not feel comfortable providing companies with their personal contact details (as is required from the on-site behavior of emailing companies from ChoiceMart) and logistic regression showed that these visitors who did not feel comfortable providing companies with their personal contact details were 1.30 times less likely to email companies ($\chi^2 = 19.60$ (7), $p < .01$). This finding justifies the development of an on-site behavior option that does not involve disclosing personal information, especially contact details.

Behavior Intention:

Historically, most zoos and aquariums have focused their 'call to action' messaging around financial behaviors such as asking visitors to make monetary donations towards conservation efforts. These donations often come in the form of 'adopting' animals, organizing fundraisers or pledging monthly contributions to an organisation. This study found intentions to engage in financial behaviors ranked the lowest of all behavior items (Table 10), indicating that while visitors may be keen to support conservation efforts, many are unwilling to provide that support as a monetary offering.

This study identified consumer behaviors as the highest-ranking behaviors that visitors were likely to perform. These included actions such as making changes to dietary and consumer purchasing habits. This finding supports Taronga Zoo's decision to focus on sustainable palm oil consumer behaviors as the primary off-site 'call to action' for this new experience and this study reveals a strong indicator that this messaging is effective, with "I will only purchase products with Certified Sustainable Palm Oil" ranking as most likely to be engaged in by visitors, with the highest mean rating of agreement compared to the 13 other items, (Table 10).

Knowledge:

Results were consistent with other studies that found weak to no relationship between knowledge and behavior outcomes. Whilst a comparison of the pre-visit and post-visit knowledge did reveal a highly significant increase in correct answers for all three items, there were no statically significant relationships between knowledge and either of the desired behaviors.

We did find that visitors who understood unsustainable palm oil plantations are destroying tiger habitats were 4.25 times more likely to report an intention to engage in the desired off-site behavior of only purchasing products with Certified Sustainable Palm Oil ($p <$ .000). Correct understanding of this item increased from 51.5% pre-visit to 75.2% post visit ($p <$ .001), which is encouraging, however, it would be beneficial to strengthen interprative messaging around this item with the aim of increasing knowledge towards 100% considering the link between this item and participation in the desired off-site behavior.

Longitudinal Data:

One of the most encouraging results from this study was that the longitudinal data collected over six months post zoo visit provided a new insight into the temporal components of conservation behavior change and reveal an encouraging finding that targeted behaviors are both engaged in and maintained by visitors post zoo visit. These findings also support the idea that visitors are most willing to engage in consumer behaviors such as avoiding buying a product because it was not sustainably produced, and least likely to engage in financial behaviors such as becoming a ZooParent by 'adopting' a Sumatra Tiger" or making a monthly donation.

Conclusion

This study has shown that immersive, interactive exhibit design and interprative messaging that focuses on one species and one conservation threat can proactively inspire immediate and long term personal and consumer behavior change in zoo visitors. A more robust understanding of the ways in which modern visitors are both willing and able to contribute to campaigns can result in far greater engagement. As such, zoos should feel empowered to look beyond traditional exhibit design and requests for monetary donations and recruit innovations in technology to inspire and empower visitors towards novel action for issues of conservation concern.

Several limitations restrict the generalizability of these findings. The findings here are species and campaign specific and there is the potential for a social response bias to exist. Future studies could include items to check for a social response bias when zoo exhibit message testing is a key element. Additionally, this study would have benefited from a larger scale size and replications over different exhibits with different species and campaigns.

This article provided a framework for zoos and other conservation organisations to rethink the types of on-site and off-site behaviors they are asking visitors to engage in and to evaluate the mechanisms and interprative messaging used to inspire and facilitate that engagement. The positive indication towards engagement with consumer and personal behaviors is encouraging and could help provide achievable ways for a greater number of visitors to contribute towards specific issues of conservation importance.

Chapter 3 - Conclusion

This chapter is a reflection on the entire process of the development of this thesis as well as a reflection on the outcomes of this research. This thesis represents the culmination of 18 months of work and countless hours of reviewing literature, thinking, collecting and analyzing data, and writing. I am grateful to Dr. Skibins for providing me with the funding to make this opportunity a reality. I think I have learned invaluable skills regarding project management as well as research theories and methodologies.

This thesis originated from an interest in conservation psychology, environmental education and wildlife interpretation as well as well as an opportunity afforded to be by my pre-existing connection with the Taronga Conservation Society Australia. After considerable research into different models of behavior change, I was excited to discover the I-Change model as I felt it posed an opportunity to explore the potential for a larger and more diverse and comprehensive pool of factors to be considered as they relate to modifying and predicting pro-conservation behavior change. I had high hopes that my research findings would contribute important new knowledge to the fields of conservation psychology, environmental education and wildlife interpretation.

Unfortunately, I feel disappointed with the overall outcome of this project and attribute these shortcomings to poorly designed survey instruments and sub-optimal data analysis. If I had the ability to go back in time, I would have tried to gain a far deeper understanding of behavior change theory and developed my survey instrument in a way that allowed each factor to be considered as one or more composite variables, with greater consistency between factors and more intricate items that were supported by a deep understanding of psychology. I also wish that I could have learn how to do structural equation modelling or some other type of data analysis

that investigated the intricate relationships between all my variables to allow me to quantify all the relationships between factors in my modified I-Change model.

All things considered, I think my thesis is a solid project evaluation that will be helpful for Taronga Zoo to understand how the messaging components of the TigerTrek exhibit are being perceived and how this is affecting visitor's likelihood to engage in the desired pro-conservation behaviors both on-site and off-site, as well as identifying barriers which are currently preventing visitors from doing these behaviors. While I was hoping for a far more impactful outcome, I have learnt a lot about the social science research process that will hopefully allow me to do things differently to achieve a more impactful outcome if I choose to progress on to a PhD in the future.

I am pleased with the experience that completing my Master of Science degree provided. I was given the opportunity to experience living in and competing grad school in the USA, to conduct field work at incredible locations and to form professional relationships with a number of influential academics. Thank you to everyone from the Park Management and Conservation program and the Graduate School at K-State University for providing me with these excellent opportunities to grow personally, professionally and academically.

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Appendix A - Survey Instrument

TARONGA CONSERVATION SOCIETY AUSTRALIA®

KANSAS STATE UNIVERSITY | Park Management and Conservation

Hello, my name is Ashley Kelly and I am a Guest Experience Officer at Taronga Zoo as well as a Masters student at Kansas State University. I am conducting a study on the Tiger Trek experience. All responses are confidential & anonymous. Thank you very much for participating.

1. How frequently do the following apply to you?	Never	Rarely	Sometimes	Often	Always
I take re-usable bags to the shops with me	❑	❑	❑	❑	❑
I use a re-usable cup or bottle	❑	❑	❑	❑	❑
I walk or ride a bicycle	❑	❑	❑	❑	❑
I carpool or use public transport	❑	❑	❑	❑	❑
My meals contain red meat, poultry or seafood	❑	❑	❑	❑	❑
I choose recycled paper products	❑	❑	❑	❑	❑
I try to buy products which I know are ethical and sustainable	❑	❑	❑	❑	❑

2. Please indicate your level of agreement with the following:	Strongly Disagree	Neutral ⟷			Strongly Agree
Unsustainable palm oil plantations are destroying the habitats of Sumatran Tigers	-2	-1	0	1	2
Sumatran Tigers have as much right to exist as any human	-2	-1	0	1	2
Ensuring Sumatran Tigers' survival is my highest priority	-2	-1	0	1	2
Wildlife protection must be societies' highest priority	-2	-1	0	1	2
It is humans' job to protect Sumatran Tigers from extinction	-2	-1	0	1	2
I am willing to alter my lifestyle to protect Sumatran Tigers	-2	-1	0	1	2
Buying ethical & sustainable products is important to me	-2	-1	0	1	2
I believe my consumer choices have global impact	-2	-1	0	1	2
It is necessary to human existence to make use of natural resources as we see fit	-2	-1	0	1	2
Environment groups are always lecturing us on what we should or shouldn't buy or do.	-2	-1	0	1	2
It's up to governments and regulators to ensure products are ethically produced	-2	-1	0	1	2
It's up to suppliers and retailers to ensure products are ethically produced	-2	-1	0	1	2
It's up to us as consumers to use our purchasing power to encourage retail stores to only sell sustainable and ethical products	-2	-1	0	1	2

3. Please indicate your level of agreement with the following:	Strongly Disagree	Neutral ⟷			Strongly Agree
I want to support tiger conservation but I do not know how	-2	-1	0	1	2
I think all palm oil is bad and that it should be boycotted	-2	-1	0	1	2
I do not think companies will listen to emails sent through ChoiceMart	-2	-1	0	1	2
I do not believe palm oil can be sustainable	-2	-1	0	1	2
I do not know how to identify products that contain Sustainable Palm Oil	-2	-1	0	1	2
I do not feel comfortable providing companies with my personal contact details	-2	-1	0	1	2
I do not trust companies claims that their palm oil comes from sustainable sources	-2	-1	0	1	2

4. How would the following impact your ability to advocate for sustainable palm oil?	No Impact	⟷			Major Impact
Education campaigns so I can learn more about sustainable palm oil	0	1	2	3	4
More compelling evidence to justify why I should take action	0	1	2	3	4
A list of options for ways I can take action	0	1	2	3	4
Guidance on which brands I could contact	0	1	2	3	4
Pre-written information for me to use when contacting brands	0	1	2	3	4
More confidence in the certification process for sustainable palm oil	0	1	2	3	4
More confidence that my actions will have an impact	0	1	2	3	4
Evidence that a supply of palm oil is ethical, traceable and verified	0	1	2	3	4
A product labelling system approved by independent environment groups	0	1	2	3	4
A social media page with content I can share	0	1	2	3	4

PLEASE TURN OVER AND CONTINUE ON BACK OF PAGE

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5. Please indicate how likely it will be for you to do the following:

	Extremely Unlikely		Neutral ↔		Extremely Likely
I will volunteer for a wildlife conservation organization	-2	-1	0	1	2
I will do my own research to avoid buying products that are not sustainably produced	-2	-1	0	1	2
I will only purchase products with Certified Sustainable Palm Oil	-2	-1	0	1	2
I will organise a fundraiser for Taronga's conservation projects	-2	-1	0	1	2
I will use social media to help raise awareness	-2	-1	0	1	2
I will contact a member of parliament to ask for action	-2	-1	0	1	2
I will contact a company to ask for action	-2	-1	0	1	2
I will change my diet to support environmental protection	-2	-1	0	1	2
I will become a Taronga Zoo Parent by 'adopting' a Sumatra Tiger	-2	-1	0	1	2
I will speak to family or friends to help raise awareness	-2	-1	0	1	2
I will make a monthly donation for Taronga's conservation projects	-2	-1	0	1	2
Even when they are more expensive, I will only buy products that support wildlife	-2	-1	0	1	2
I will join a march/protest/rally for environmental action	-2	-1	0	1	2
Environmental issues will be my top priority in government voting	-2	-1	0	1	2

6. Do you have concerns that SOME palm oil is grown unsustainably ❑ Yes ❑ No
7. Do you have concerns that ALL palm oil is grown unsustainably? ❑ Yes ❑ No
8. Did you download the Taronga Zoo app? ❑ Yes ❑ No

9. How many Sumatran Tigers are there in the wild? (Please select one)
❑ <400 ❑ 400 – 2,000 ❑ >2,000

10. What is the conservation status of Sumatran Tigers? (Please select one)
❑ Least concern ❑ Near threatened ❑ Vulnerable ❑ Endangered ❑ Critically Endangered

11. Which of these statements best reflects your shopping habits in the past? (Please select one)
❑ Palm oil is not a consideration in my purchasing decisions ❑ I sometimes choose products because they contain sustainable palm oil ❑ I always choose products because they contain sustainable palm oil ❑ I try to avoid buying products that contain any palm oil

12. What is your gender? ❑ Female ❑ Male

13. In what year where you born? _____

14. Where do you live?
❑ Australia (what is your postcode?) _____ ❑ Overseas (which country?) _____

15. What is the highest schooling qualification you have completed?
❑ Primary School (Yrs 1-6) ❑ Secondary School (Yrs 7-10) ❑ Secondary School/HSC (Yrs 11-12)
❑ Certificate/Diploma ❑ Undergraduate degree ❑ Post graduate degree

16. Are you a member of Taronga's ZooFriends? ❑ No ❑ Yes

17. Are you a member of any other conservation organisation?
❑ No ❑ Yes: Please list if you wish _____

18. May we contact you for a brief follow up survey? (Answer YES to go in the draw to win a Taronga Zoo Prize Pack!)
❑ No ❑ Yes: Please provide email address: _____

19. Do you have any further comments? _____

_____

_____

Thank you for your help! If you have questions regarding this survey, please contact
Ashley Kelly ◊ Kansas State University ◊ 0422 951 252 ◊ ashleykelly@ksu.edu

Researcher use only: Survey number: Date:

Hello, my name is Ashley Kelly and I am a Guest Experience Officer at Taronga Zoo as well as a Masters student at Kansas State University. I am conducting a study on the Tiger Trek experience. All responses are confidential & anonymous. Thank you very much for participating.

1. How frequently do the following apply to you?

	Never	Rarely	Sometimes	Often	Always
I take re-usable bags to the shops with me	❑	❑	❑	❑	❑
I use a re-usable cup or bottle	❑	❑	❑	❑	❑
I walk or ride a bicycle	❑	❑	❑	❑	❑
I carpool or use public transport	❑	❑	❑	❑	❑
My meals contain red meat, poultry or seafood	❑	❑	❑	❑	❑
I choose recycled paper products	❑	❑	❑	❑	❑
I try to buy products which I know are ethical and sustainable	❑	❑	❑	❑	❑

2. Please indicate your level of agreement with the following:

	Strongly Disagree		Neutral ⟷		Strongly Agree
The exhibit delivered a clear, understandable message	-2	-1	0	1	2
The exhibit's message was personally relevant & applicable to me	-2	-1	0	1	2
Unsustainable palm oil plantations are destroying the habitats of Sumatran Tigers	-2	-1	0	1	2
Sumatran Tigers have as much right to exist as any human	-2	-1	0	1	2
Ensuring Sumatran Tigers' survival is my highest priority	-2	-1	0	1	2
Wildlife protection must be societies' highest priority	-2	-1	0	1	2
It is humans' job to protect Sumatran Tigers from extinction	-2	-1	0	1	2
I am willing to alter my lifestyle to protect Sumatran Tigers	-2	-1	0	1	2
Buying ethical & sustainable products is important to me	-2	-1	0	1	2
I believe my consumer choices have global impact	-2	-1	0	1	2
It is necessary to human existence to make use of natural resources as we see fit	-2	-1	0	1	2
Environment groups are always lecturing us on what we should or shouldn't buy or do.	-2	-1	0	1	2
It's up to governments and regulators to ensure products are ethically produced	-2	-1	0	1	2
It's up to suppliers and retailers to ensure products are ethically produced	-2	-1	0	1	2
It's up to us as consumers to use our purchasing power to encourage retail stores to only sell sustainable and ethical products	-2	-1	0	1	2

3. Please indicate your level of agreement with the following:

	Strongly Disagree		Neutral ⟷		Strongly Agree
I want to support tiger conservation but I do not know how	-2	-1	0	1	2
I think all palm oil is bad and that it should be boycotted	-2	-1	0	1	2
I do not think companies will listen to emails sent through ChoiceMart	-2	-1	0	1	2
I do not believe palm oil can be sustainable	-2	-1	0	1	2
I do not know how to identify products that contain Sustainable Palm Oil	-2	-1	0	1	2
I do not feel comfortable providing companies with my personal contact details	-2	-1	0	1	2
I do not trust companies claims that their palm oil comes from sustainable sources	-2	-1	0	1	2

4. How helpful were the following parts of the exhibit on your understanding of the benefits of sustainable palm oil for Sumatran Tiger conservation?

	Extremely Unhelpful		Neutral ⟷		Extremely Helpful
The simulated 'Airplane' experience	-2	-1	0	1	2
The Way Kambas Village experience	-2	-1	0	1	2
The Ranger Station	-2	-1	0	1	2
The tiger enclosure viewing areas	-2	-1	0	1	2
Choice Mart supermarket simulation	-2	-1	0	1	2
Speaking with a Taronga staff or volunteer	-2	-1	0	1	2
Digital video screens	-2	-1	0	1	2
Signage	-2	-1	0	1	2

5. How would the following impact your ability to advocate for sustainable palm oil?

	No Impact		⟷		Major Impact
Education campaigns so I can learn more about sustainable palm oil	0	1	2	3	4
More compelling evidence to justify why I should take action	0	1	2	3	4
A list of options for ways I can take action	0	1	2	3	4
Guidance on which brands I could contact	0	1	2	3	4
Pre-written information for me to use when contacting brands	0	1	2	3	4
More confidence in the certification process for sustainable palm oil	0	1	2	3	4
More confidence that my actions will have an impact	0	1	2	3	4
Evidence that a supply of palm oil is ethical, traceable and verified	0	1	2	3	4
A product labelling system approved by independent environment groups	0	1	2	3	4
A social media page with content I can share	0	1	2	3	4

AFTER

PLEASE TURN OVER AND CONTINUE ON BACK OF PAGE

6. Please indicate how likely it will be for you to do the following:	Extremely Unlikely		Neutral ⟷		Extremely Likely
I will volunteer for a wildlife conservation organization	-2	-1	0	1	2
I will do my own research to avoid buying products that are not sustainably produced	-2	-1	0	1	2
I will only purchase products with Certified Sustainable Palm Oil	-2	-1	0	1	2
I will organise a fundraiser for Taronga's conservation projects	-2	-1	0	1	2
I will use social media to help raise awareness	-2	-1	0	1	2
I will contact a member of parliament to ask for action	-2	-1	0	1	2
I will contact a company to ask for action	-2	-1	0	1	2
I will change my diet to support environmental protection	-2	-1	0	1	2
I will become a Taronga Zoo Parent by 'adopting' a Sumatra Tiger	-2	-1	0	1	2
I will speak to family or friends to help raise awareness	-2	-1	0	1	2
I will make a monthly donation for Taronga's conservation projects	-2	-1	0	1	2
Even when they are more expensive, I will only buy products that support wildlife	-2	-1	0	1	2
I will join a march/protest/rally for environmental action	-2	-1	0	1	2
Environmental issues will be my top priority in government voting	-2	-1	0	1	2

7. Do you have concerns that SOME palm oil is grown unsustainably ❑ Yes ❑ No
8. Do you have concerns that ALL palm oil is grown unsustainably? ❑ Yes ❑ No
9. Did you download the Taronga app? (If no, skip to Q13) ❑ Yes ❑ No
10. Did you use the Wild Squad Tiger Mission on the Taronga app? ❑ Yes ❑ No
11. Did you use the Taronga app to scan QR codes in ChoiceMart? ❑ Yes ❑ No
12. Did you email companies in ChoiceMart from the Taronga app? ❑ Yes ❑ No
13. Did you interact with the screens in ChoiceMart? (If no, skip to Q15) ❑ Yes ❑ No
14. Did you email companies in ChoiceMart from the screens? ❑ Yes ❑ No

15. How satisfied are you with your overall exhibit experience | **16. How satisfied are you with your tiger viewing experience?**

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 | ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5
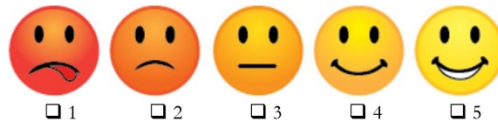
17. Which of these statements best reflects your tiger viewing experience today? (Please select one)
❑ I did not see a tiger ❑ I only saw a tiger in the distance ❑ I had a good view of a tiger ❑ I had an incredible view of a tiger

18. How many Sumatran Tigers are there in the wild? (Please select one)
❑ <400 ❑ 400 – 2,000 ❑ >2,000

19. What is the conservation status of Sumatran Tigers? (Please select one)
❑ Least concern ❑ Near threatened ❑ Vulnerable ❑ Endangered ❑ Critically Endangered

20. Which of these statements best reflects your shopping habits in the past? (Please select one)
❑ Palm oil is not a consideration in my purchasing decisions ❑ I sometimes choose products because they contain sustainable palm oil ❑ I always choose products because they contain sustainable palm oil ❑ I try to avoid buying products that contain any palm oil

21. What is your gender? ❑ Female ❑ Male

22. In what year where you born? _____

23. Where do you live?
❑Australia (what is your postcode?) _____ ❑ Overseas (which country?) _____

24. What is the highest schooling qualification you have completed?
❑ Primary School (Yrs 1-6) ❑ Secondary School (Yrs 7-10) ❑ Secondary School/HSC (Yrs 11-12)
❑ Certificate/Diploma ❑Undergraduate degree ❑ Post graduate degree

25. Are you a member of Taronga's ZooFriends? ❑ No ❑ Yes

26. Are you a member of any other conservation organisation?
❑ No ❑ Yes: Please list if you wish _____

27. May we contact you for a brief follow up survey? (Answer YES to go in the draw to win a Taronga Zoo Prize Pack!)
❑ No ❑ Yes: Please provide email address: _____

28. Do you have any further comments? _____

Thank you for your help! If you have questions regarding this survey, please contact
Ashley Kelly ◊ Kansas State University ◊ 0422 951 252 ◊ ashleykelly@ksu.edu

Researcher use only: Survey number: Date:

Appendix B - IRB Approval

KANSAS STATE
U N I V E R S I T Y | University Research Compliance Office

TO: Dr. Jeffrey Skibins   Proposal Number: 9024
        Horticulture and Natural Resources
        2021 Throckmorton

FROM: Rick Scheidt, Chair
        Committee on Research Involving Human Subjects

DATE: 11/13/2017

RE: Proposal Entitled, "Evaluating the Effectiveness of the New Sumatran Tiger Trek in Driving
        Behavior Change in Zoo Guests"

The Committee on Research Involving Human Subjects / Institutional Review Board (IRB) for Kansas State
University has reviewed the proposal identified above and has determined that it is EXEMPT from further
IRB review. This exemption applies only to the proposal - as written – and currently on file with the IRB.
Any change potentially affecting human subjects must be approved by the IRB prior to implementation and
may disqualify the proposal from exemption.

Based upon information provided to the IRB, this activity is exempt under the criteria set forth in the
Federal Policy for the Protection of Human Subjects, **45 CFR §46.101, paragraph b, category: 2,**
subsection: ii.

Certain research is exempt from the requirements of HHS/OHRP regulations. A determination that
research is exempt does not imply that investigators have no ethical responsibilities to subjects in such
research; it means only that the regulatory requirements related to IRB review, informed consent, and
assurance of compliance do not apply to the research.

Any unanticipated problems involving risk to subjects or to others must be reported immediately to the
Chair of the Committee on Research Involving Human Subjects, the University Research Compliance
Office, and if the subjects are KSU students, to the Director of the Student Health Center.

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comply@k-state.edu | k-state.edu/research/comply