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REVIEW ARTICLE

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Facilitating behavior change: Introducing the Transtheoretical Model of Behavior Change as a conservation psychology framework and tool for practitioners

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Abstract

The primary opportunities for improved conservation and sustainability outcomes are through changing human behavior. Zoos, aquariums, and other public-facing biodiversity conservation institutions offer an important space for environmental learning and facilitating proenvironmental behavior change. We have focused, in this review, on examining common behavior change models as well as the Transtheoretical Model (TTM) of Behavior Change, a widely regarded model within the health fields and, recently, in the fields of environmental and leadership studies, with new research applying the TTM specifically in a zoo setting. We have discussed critiques of the TTM and rebuttals to those critiques. We have presented examples of TTM applications in a zoo setting. Our objective has been to explore the TTM as a possible "best fit" framework and tool for zoo and aquarium practitioners in facilitating proenvironmental behavior. Key findings include that (a) the TTM differs significantly from other proenvironmental behavior theoretical models, including those that are prevalent in the conservation psychology literature and applied by zoos and aquariums, in terms of the TTM stages of change and processes of change constructs; (b) the TTM appears to overlap significantly with the 10 interventions or treatments identified by researchers as the most effective approaches to facilitating proenvironmental behavior; and (c) there is nascent and promising application of TTM constructs in zoo and aquarium programming. We remain impressed by the potential of the TTM to address a critical question within the conservation psychology research field concerning proenvironmental behavior: what specific tools to employ and when.

KEYWORDS

conservation psychology, environmental learning, proenvironmental behavior, Transtheoretical Model of Behavior Change

1 | INTRODUCTION

Zoos, aquariums (Z/A), and other public-facing biodiversity conservation institutions play a key role in environmental education. Yet education is only the first step in facilitating actual change. We argue that Z/A, through programming and engagement with visitors, can build on this educational foundation to play a critical role in supporting new behaviors that contribute to conservation.

Human behavior change is key to conservation solutions (Heberlein, 2012; Saunders, 2003; Schultz, 2011, 2013; Stern, 2000a). Systems and inputs that influence behavior choices include culture, economic systems, formal and informal educational programs, private sector leadership, public policy, and technological innovations (Abrash Walton, 2018). Proenvironmental behavior (PEB) "harms the environment as little as possible, or even benefits the environment" (Steg & Vlek, 2009, p. 309). Encouraging individuals to engage in PEB at an organizational level—or for sectors of society—where individual behavior is shaped and aggregated by organizational or sectoral policies and practices, is a critical locus for change (Robertson & Barling, 2013; Stern, 2000b, 2011).

The integrity of conservation psychology as a field of research and practice is grounded in rigorous research. Saunders (2003), in proposing the new field, emphasized its applied nature and the value of enhancing connections between research and practice, between the social and natural sciences, and between psychology and other social sciences. The field's success depends upon researchers' ability to identify theory, methods, and applied recommendations and techniques that yield demonstrable and effective sustainability outcomes (Clayton & Myers, 2009; Salafsky, 2003; Stern, 2003). Commentators on conservation psychology have challenged the emerging field's applied utility. For example, Salafsky (2003) wrote,

> "can conservation psychology create general and yet nontrivial principles… that will be of use to practitioners? To me, the most fertile ground lies in… behavioral modification…. It would be nice to get beyond the theory and get down to nuts-and-bolts principles as to the specific steps a project would need to take to effectively modify specific behaviors in a specific set of people under specific conditions…. What [conservation practitioners] need are trained people, useful methods, and tested knowledge that they can use to improve their day-to-day work." (p. 176)

Our research review was designed to address the gap identified by Salafsky by focusing on empirically tested and applicable methods that can support Z/A in becoming more effective in facilitating improved conservation outcomes. We discuss, in the next section, some common Z/A PEB change models. We then introduce the Transtheoretical Model (TTM) of Behavior Change as one rigorously evidence-based approach as a possible "best fit" for application in Z/A and other conservation settings. We also provide specific TTM-based examples of Z/A programming to facilitate conservation behaviors.

2 | COMMON PEB CHANGE MODELS

We discuss, here, six common theoretical models that have influenced Z/A programming and interventions: Knowledge-Attitudes-Behavior (K-A-B)/Communication Action, Theory of Planned Behavior, Responsible Environmental Behavior (REB) model, Reasonable Person model, Health Belief model (HBM), and Community-based Social Marketing (CBSM). Each model includes at least one construct similar to the TTM.

2.1 | K-A-B/Communication Action

One approach common across Z/A is based on the concept that "if I can get you to understand something, you'll care about it, and then you'll want to do something about it/for it." This approach, known as the K-A-B or Communication Action model (1935), posits that knowledge about a behavior leads to development of *a predisposition* to respond, an attitude, leading to a congruent behavior. The strength of an attitude correlates to behavior (Luttrell & Sawiki, 2020).

2.2 | Theory of Planned Behavior

The Theory of Planned Behavior (Ajzen, 1991) suggests that intentions to perform behaviors can be predicted through attitudes toward a behavior, subjective norms, and perceived behavioral control. This social behavior model proposes that intentions can be predicted by practitioners and fostered in such a way that leads to behavior change. The concept of *intention* highlights "how hard people are willing to try…to perform the behavior" (Ajzen, 1991).

2.3 | REB model

Following other studies trying to predict behaviors that would be environmentally beneficial, Hines et al. (1987) produced a critical synthesis exploring REBs. They offered a model in which (a) attitudes (affect and cognition); (b) locus of control; and (c) personal responsibility lead to personality factors supporting knowledge of action strategies, action skills, and environmental issues, which together can lead to an intention to act. Many educators have used this predictive model as a framework for program design, but the linearity of the prediction is dependent on interaction effects and other conditions. Later studies explored connections among those components. Ultimately, the model serves as a useful tool for studying and measuring REBs, but is too complex and cumbersome to use for program design. Indeed, Hines et al. (1987, p. 8) clearly stated "research efforts must concentrate on all factors in the behavior

picture rather than continuing to isolate individual components from those variables with which they likely interact."

2.4 | Reasonable Person model

The Reasonable Person model (Kaplan, 2000) suggests that individuals are more "reasonable" in their decision-making when the environment supports their basic information needs. The concept of meaningful behavior based on knowledge is common in Z/A. But it is not always possible to enact participatory problem solving and engaging people in the process, a necessary part of the model. Another contribution of this model was the inclusion of self-interest, especially as it relates to more difficult behaviors to change or perform (Corbett, 2005).

2.5 | HBM

A prominent Z/A approach, similar to the HBM (Rosenstock, 1974), has focused on conveying perceived threats to wildlife and to their habitats. The theory suggests that the stronger an individual's perceived severity of a negative outcome is, along with the perception that barriers to performing the new behavior are low, the more likely they are to develop self-efficacy to engage in the new behavior (Carpenter, 2010).

2.6 | CBSM

Another popular Z/A approach is promoting specific campaigns that "ask visitors to engage in a specific, predetermined behavior linked to a conservation issue" (Mellish et al., 2018). CBSM (Heimlich & Ardoin, 2008; McKenzie-Mohr, 2000) focuses on the social context for the intervention and desired behavior change. The social contextual pieces include norms and commitments, in addition to prompts and rewards. This approach to facilitating PEB emphasizes "personalized channels of communication…most CBSM programs aim to provide one-on-one communications with members of the target audience" (Schultz, 2013). CBSM approaches typically focus on increasing the perceived benefits of a particular behavior and decreasing the barriers to engaging in that behavior. Limitations of the CBSM-based approach include the financial resources necessary to mounting an effective intervention, and the related challenge of the time available for the intervention/program. There are few studies demonstrating CBSM interventions resulting in actual changes in visitor behavior (Falk et al., 2007).

This overview of commonly applied behavior change models suggests that Z/A do not yet widely use a rigorously evidence-based and easily applied framework that synthesizes theories and methods for change. We discuss next the TTM as a possible "best fit" for Z/A.

3 | TTM OF BEHAVIOR CHANGE

The TTM of Behavior Change is a research- and evidence-based integrative psychological model for understanding and facilitating behavior change. The TTM draws on an array of psychological theories about behavior change and the specific processes that can facilitate change. The model moves beyond the old theory of change that "if people just know enough, they'll change." Instead, the TTM posits that individuals must be ready to do the new behavior, view the benefits of the change outweighing the cons, and feel confident about their ability to change. The TTM also provides 10 proven techniques for facilitating change.

More than 35 years of empirical research has validated the model's measures and constructs in an array of contexts (Norcross et al., 2013), including among culturally diverse populations (Hall & Rossi, 2008). The model has been applied to understanding and facilitating change with respect to some 50 individual behaviors (e.g., smoking cessation, diet, exercise) (Norcross et al., 2013; J. M. Prochaska, 2006; J. O. Prochaska, 2008) as well as to a range of organizational change initiatives (Levesque et al., 1999; J. M. Prochaska, 2000; J. M. Prochaska et al., 2001, 2006). The diversity of these contexts and participants highlight the flexibility and wide applicability of the TTM. There are examples of the TTM being used in tourism contexts (Dierking et al., 2004; Mair & Laing, 2013; Smith et al., 2019). It has also already been used with interventions to promote sustainable behaviors such as green eating (Monroe et al., 2015; Weller et al., 2014), sustainable transportation (Mundorf et al., 2018; Redding et al., 2014), and landscaping decisions (Shaw et al., 2011). This suggests the TTM's usefulness for promoting the types of PEBs encouraged by zoos and aquariums.

Scholars and researchers appear to agree upon at least three things: (a) the conceptual and intuitive attraction of the TTM as a theoretical framework; (b) the widespread popularity and usage of the TTM among practitioners; and (c) the demonstrated success of stage-matched interventions in facilitating short-term behavior change.

We find the TTM to be an intriguing change model because of its rigorously and empirically validated success with respect to facilitating behaviors by individuals, its inclusive and fluid approach, and its elegant simplicity. In this section, we present an overview of the TTM, including its four constituent constructs.

3.1 | Description of the model

The TTM is comprised of four major constructs (Figure 1):

- Stages of readiness to engage in the new behavior,
- Decisional balance inventory,
- Self-efficacy,
- Processes of change.

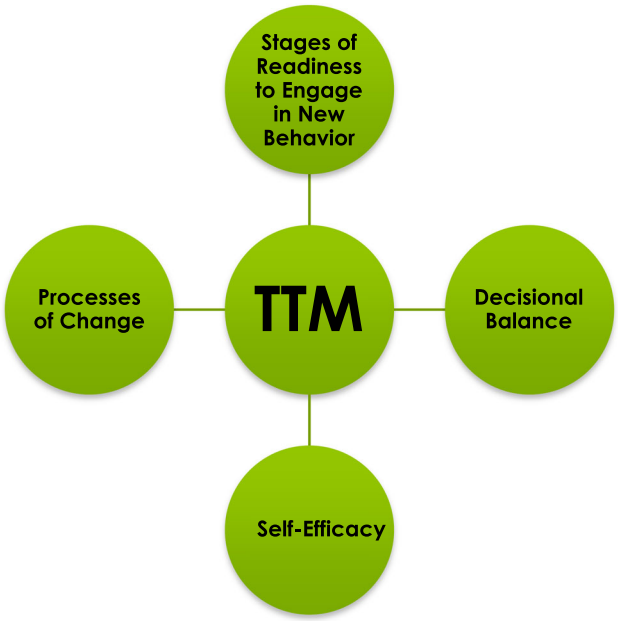

FIGURE 1 Core Transtheoretical Model (TTM) constructs (Abrash Walton, 2018)

3.1.1 | Stages of readiness to engage in the new behavior

The TTM's first construct, stages of readiness to engage in a new behavior, is based on the theory that there are five recognizable stages associated with any given behavior change. These stages are:

1. Precontemplation—not ready to engage in the new behavior (e.g., unaware, discouraged or resistant),
2. Contemplation—considering engaging in the new behavior; not yet preparing to do so,
3. Preparation—actively preparing to engage in the new behavior,
4. Action—engaging in the new behavior,
5. Maintenance—continuing the new behavior for at least a 6-month period.

Progress through these stages is not necessarily linear or steady. For example, a person might spiral through contemplation, preparation, and action more than once.

Stage classification is based on an algorithm method, using responses to questions about past behavior and future intentions. Stage of change predicts future behavior. For example, research employing the TTM to understand and facilitate smoking cessation found that study participants in contemplation before stage-matched intervention/treatment were twice as likely to quit smoking at the 18-month follow up as compared with those in precontemplation (J. O. Prochaska et al., 1992).

3.1.2 | Decisional balance inventory

The TTM's second construct, decisional balance inventory, is based on the understanding that decision-making requires consideration of the potential positive and negative consequences (Janis & Mann, 1977). These benefits and costs consist of four categories: instrumental or utilitarian gains/losses for oneself or for one's significant others, and approval or disapproval of the behavior by oneself or by one's significant others. The model posits that an individual is more likely to be satisfied with a decision if they have considered the pros (gains, facilitators) as well as the cons (losses, barriers) of the choice. Another aspect of this construct is confidence in or belief that the change behavior will be effective in achieving outcomes. For example, with respect to PEB, this might include confidence that recycling is effective in reducing energy usage and pollution associated with extracting raw materials and waste disposal.

Statistical analysis of participants' decisional balance has demonstrated that an individual's perception of the benefits of making a change must significantly increase in order for that person to progress to the action stage (Hall & Rossi, 2008). Cons of making the behavior change outweigh the pros for individuals in the precontemplation stage. Pros outweigh the cons in later stages, with the transition between a greater weight placed on cons than on pros occurring before individuals are in the action stage. Researchers found these relationships across 48 different health behaviors in 120 data sets from 10 countries (Hall & Rossi, 2008). For individuals in early stages of readiness to engage in a new behavior, it is important to recognize the advantages of engaging in the change. For individuals in later stages of readiness to engage in the change, it is important that the disadvantages of the new behavior are not too high. The perception of cons may increase initially as individuals in precontemplation begin to consider a change. A high level of pros and cons indicates ambivalence (J. O. Prochaska et al., 1994).

3.1.3 | Self-efficacy

The TTM's third construct, self-efficacy, concerns an individual's confidence in engaging in the new behavior (Bandura, 1977). Self-efficacy can influence motivation and persistence in engaging in the change, even under challenging circumstances. There are two self-efficacy components: confidence to engage in and maintain the behavior, and the possibility of cycling back to an earlier stage of readiness. Levels of self-efficacy differ systematically across the stages of readiness to engage in a new behavior. Self-efficacy increases and the possibility of relapse decreases as individuals move into action and maintenance.

3.1.4 | Processes of change

The fourth and final TTM construct is the 10 processes that can support the behavior change. Five processes employ cognitive and

affective experiences, and five processes are behavioral. The cognitive and affective experiential processes are more effective in facilitating progression through earlier stages of readiness to engage in the new behavior (precontemplation and contemplation). The behavioral strategies are more important for supporting individuals in the later stages of readiness to engage in the new behavior (preparation, action, and maintenance). The applicability of any of these 10 change processes is contingent upon the specific behavior and context in which the change is occurring.

We present here (Table 1) the processes of change (J. M. Prochaska et al., 2001; J. O. Prochaska et al., 1992). The process names are not intuitive; thus, we offer new terms to describe them. We present examples of processes, in a zoo setting, later in this paper.

Specific processes can support effective movement through the stages when provided at a particular stage (Figure 2). For example, movement from precontemplation to contemplation is best facilitated by the processes of recognizing (consciousness raising activities), reacting (dramatic relief), re-evaluating (other) (environmental re-evaluation), and realizing (social liberation). The application of any of these 10 change processes is contingent upon the specific behavior and context in which the change is occurring. There are myriad, specific ways in which each process can be implemented.

3.2 | The TTM and PEB

PEB researchers, including thought leaders within conservation psychology, have posited the utility of applying the TTM to PEB (Ardoin et al., 2013; Carrigan et al., 2011; Clayton & Myers, 2009). Their logic is similar to ours: the recognition that the TTM has repeatedly been demonstrated as an effective approach to facilitating change of specific behaviors in the health domain and, therefore, the promising possibilities for adaptation and application to PEB. In this section, we discuss specific research applying the model to PEB.

Peer-reviewed empirical studies concerning the TTM and PEB have been published only within the past decade (Abrash Walton, 2018; Howell, 2014; Redding et al., 2014; Weller et al., 2014). Abrash Walton (2018) used a qualitative research design to apply the TTM to leadership and PEB regarding climate change. The study yielded new insights into what processes may best support leaders' actions to engage the power of their institutions to address climate change, by redirecting institutional financial resources away from the fossil fuel sector. One qualitative study used the TTM as a theoretical framework for analyzing four climate change films and their potential to facilitate viewers' climate change mitigation action, based on archival film data and prior research findings. That study concluded that the TTM can be used to provide insights into the promotion of PEB, noting that the films included TTM-based processes of change

TABLE 1 Processes of change and new terms for processes of change

Process of change	New term for process of change	Description of process
Five experiential processes of change		
Consciousness raising (awareness)	Recognizing	Increasing awareness via information, education, and personal feedback about a problem behavior and potential solution
Dramatic relief	Reacting	Experiencing negative and positive emotions regarding the behavior/change; feeling emotional arousal (such as fear, anxiety, or worry) about failure to change or *status quo*, or feeling inspiration and hope about successful change
Environmental re-evaluation	Re-evaluating (other)	Assessing impact on others of your behavior and possible change
Self re-evaluation	Re-evaluating (self)	Realizing that the behavioral change is important to one's personal identity, happiness, success, and/or values
Social liberation	Realizing	Realizing that social norms are changing to support the new behavior and that there are resources available to make the change.
Five behavioral processes of change		
Self-liberation	Committing	Making a firm commitment to change; believing in one's ability to change and making commitments and recommitments to act
Helping relationships	Reaching out	Seeking and using social support to make and sustain change; interacting with people who are supportive of the change
Reinforcement management	Replacing	Substituting prochange ways of acting and thinking for old behaviors
Counter conditioning	Rewarding	Increasing rewards for new behaviors and decreasing rewards for old behaviors
Stimulus control	Restructuring	Restructuring the environment by removing reminders and cues to engage in the old behaviors; introducing reminders and cues to engage in the new behaviors

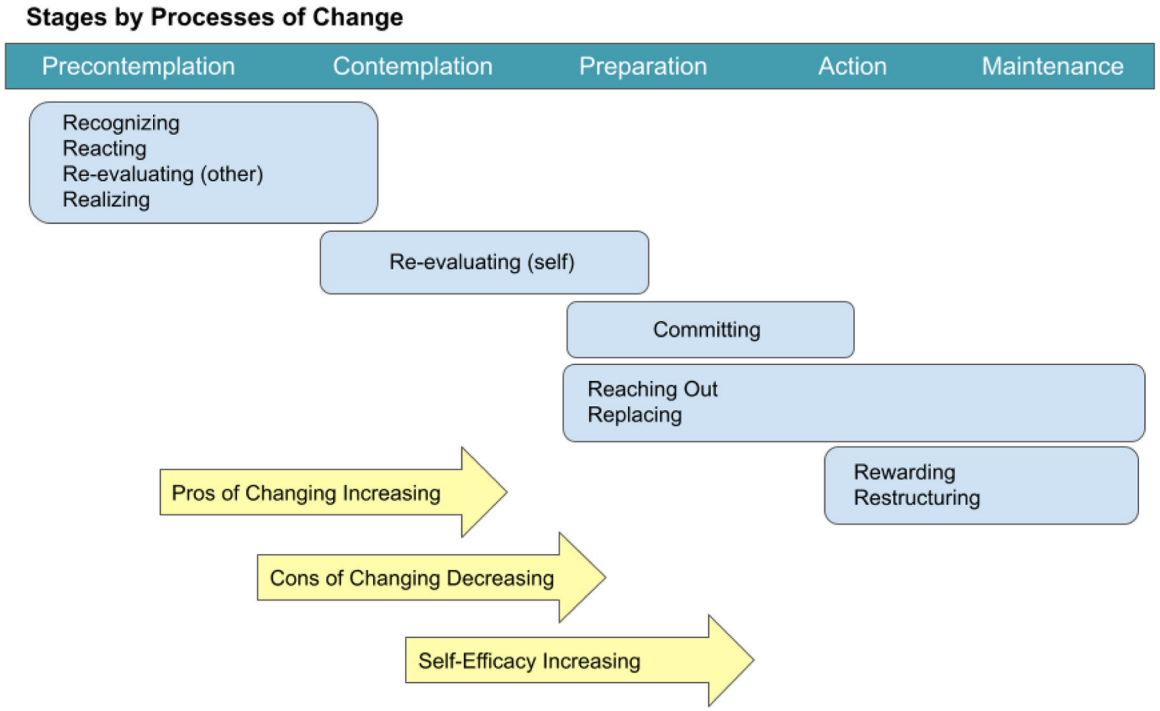

FIGURE 2 Transtheoretical Model stages by principles and processes of change (adapted from J. O. Prochaska & Velicer, 1997)

(Howell, 2014). A third study sought to develop and validate scales for the TTM constructs of stages of readiness to change, decisional balance, and self-efficacy with respect to green eating behaviors (Weller et al., 2014). The fourth study employed a similar methodology to develop and validate scales for these same TTM constructs with respect to sustainable transportation behaviors (Redding et al., 2014).

3.3 | How the TTM differs from other PEB models

The TTM differs significantly from other PEB theoretical models, including those that are prevalent in the conservation psychology literature (Osbaldiston, 2013) and applied by Z/A, in terms of the TTM stages of change and processes of change constructs. Other models have not focused on an individual's readiness to change. Instead, they have considered abstract and mechanistic determinants of behavior based on an apparently static position or snapshot rather than understanding behavior within a fluid and changing temporal and relational landscape. Most other theoretical models seem intended to be explanatory or predictive of behavior, but not necessarily facilitative, through application, of actual behavior change.

The decisional balance, self-efficacy, and processes of change constructs within the TTM are resonant with other PEB theoretical change models. However, these other models do not employ a clear, simple, fluid, empathic, inclusive, optimistic, and comprehensive approach to understanding and engaging with PEB. These attributes of the TTM seem to be a significant advantage of the model in terms of providing a theoretical and methodological framework for understanding PEB or serving as a tool that Z/A practitioners can use in facilitating PEB.

As shown in Table 2, the 10 processes of change within the TTM model appear to overlap significantly with the 10 interventions or treatments identified by researchers as the most effective approaches to facilitating PEB (Osbaldiston & Schott, 2012, pp. 272–273).

3.4 | Critiques of the TTM and rebuttals

Here, we focus on several critiques of the TTM and rebuttals, and also outline our thoughts about the model in terms of its parameters.

A primary critique of the model focuses on its stages of change construct. Critics have charged that designating five discrete stages is arbitrary and creates inconsistent and artificial markers on a motivational continuum (e.g., West, 2006; Whitelaw, in Brug et al., 2005). The rebuttal to this critique is that the stage of readiness to change ought to be understood as 1 of 15 TTM variables, not as a stand-alone theory (J. O. Prochaska, 2006). Another specific challenge of TTM analysis is its reliance on self-reported data regarding behavior and motivation.

The stage of change construct is based on a biostatistical approach to analysis in which there is not an assumption of normal distribution of variables. This is in contrast to the Pearson statistical analysis of variance common within the field of psychology. The

TABLE 2 Comparison of TTM processes of change and most effective PEB facilitative interventions and treatments

TTM processes of change	Ten most effective PEB interventions and treatments
Recognizing: increasing awareness via information, education, and personal feedback about a problem behavior and potential solution	*Justifications/Instructions*: reasons for performing a specific behavior (also called declarative information or why-to information)
Reacting: experiencing negative and positive emotions regarding the behavior/change; feeling emotional arousal (such as anxiety) about failure to change or *status quo*, or feeling inspiration and hope about successful change	
Re-evaluating (other): assessing impact on others of your behavior and possible change	*Justifications*: reasons for performing a specific behavior (also called declarative information or why-to information)
Re-evaluating (self): realizing that the behavioral change is important to personal identity, happiness, success, and/or values	*Cognitive dissonance*: accessing pre-existing beliefs or attitudes in attempt to make participants behave in ways that were consistent with those beliefs to reduce the dissonance
Recognizing: empowering individuals to engage in the change behavior by providing choices and resources; societal support for behavior; realizing that social norms are changing to support the new behavior	*Social modeling/making it easy*: passing of information via demonstration or discussion in which the initiators indicate that they personally engage in the behavior; changing situational conditions, involved making behaviors easier to do
Committing: making a firm commitment to change; believing in one's ability to change and making commitments and recommitments to act on that belief	*Goal setting/commitment*: aim for a predetermined goal; make some sort of verbal or written commitment to engage in a behavior
Reaching out: seeking and using social support to make and sustain change; interacting with people who are supportive of the change	
Replacing: substituting new ways of acting/thinking for old behaviors	*Making it easy*: changing situational conditions, involved making behaviors easier to do
Rewarding: increasing rewards for new behaviors; decreasing rewards for old behaviors	*Rewards*: any kind of monetary gain that people received as a result of participating in the experiment
Restructuring: removing reminders and cues to engage in the old behaviors; introducing reminders and cues to engage in the new behaviors	*Prompts*: noninformational reminders to perform the next specific action; *Feedback*: information about the extent to which a behavior has been performed in an earlier time frame

stages of change construct can be understood from the perspective of epidemiological or medical disciplines focused on treatment protocols and enhancement of well-being. It makes sense as a method for assessing when to engage specific interventions found to be effective in facilitating behavior change at different levels of decisional balance, commitment and self-efficacy (J. O. Prochaska, 2006). Those interventions are encompassed by the TTM's 10 processes of change construct.

Harre (in Brug et al., 2005) noted the importance of considering the TTM in conjunction with additional complementary strategies for supporting long-term behavior change. This combined approach to facilitating effective long-term behavior change is supported by Ardoin et al. (2013) in their assertion that programs employ short-term behavior change strategies in conjunction with sustained education designed to enhance knowledge and build skills to engage in PEB. Achieving long-term change may rely on structural change, with stage-matched approaches used to effect motivation of initial behavior change. Stage-matched interventions have also been demonstrated to be more effective than stage-mismatched interventions.

What most critiques seem to neglect is the TTM model's 10 processes of change construct. The specific focus of the critiques is the stages of change construct. The processes of change construct, within the TTM, appears to complement many of the types of facilitative strategies that critics identify.

Critiques (West, 2005) of the TTM have ignored longitudinal research that consistently has found a relative lower incidence of success in sustaining behavior change by individuals at earlier stages of readiness to change than for those at more advanced stages (DiClemente, 2005). The stage of change is also a state rather than a trait, and as such, is subject to instability, even within brief time horizons (DiClemente, 2005). The TTM has resonated both with individuals seeking to change as well as with those practitioners providing change facilitation. This "ground truthing" of the TTM is consistent with the model's origins in grounded theory and with other critics' observations of widespread support for the TTM (Whitelaw, in Brug et al., 2005).

One potential critique of the TTM that we did not find in any of the literature surfaced as part of this review is the understanding that there are implicit values assumptions, in the research and application of this model, about what behaviors should change. We suggest that this potential challenge may be addressed through a participatory action decision-making process that combines the best available analysis regarding efficacy of targeted behavior, drawing on a plurality of ways of knowing, including environmental advocacy

research, traditional ecological knowledge, and scientific analysis. Where a specific community may be identified and engaged, codesigning conservation programs offer opportunities to identify collaboratively the specific behaviors that could be the focus of interventions/programming, based on the outcomes desired by the community and in consideration of what evidence-based research identifies as important for improved conservation and sustainability outcomes.

A second potential challenge, in the context of PEB, is that the TTM requires that the change agent engaging in an intervention must be willing to put aside the necessity that the individual who is the target of the intervention will change. For the TTM's processes of change to be effective, the intervener must be open to authentically and genuinely engaging with the individual and understanding where that person is with respect to the proposed change. This requires respecting that person's free choice as opposed to just being patient and then telling the person that they must change (Miller & Rollnick, 2002).

What Miller and Rollnick refer to as the unconstructive dynamics of the "righting reflex" can be a particular challenge for practitioners focused on facilitating PEB. This challenge may also pertain to researchers in the field of conservation psychology, which is positioned as a mission-based endeavor (Clayton & Myers, 2009; Saunders, 2003), and to Z/A staff.

Another challenge of the TTM, as it applies to PEB, is that the specific behavior that is the target of a change initiative must be achievable by anyone within the target population. This suggests that application of the TTM to PEB must be considered carefully either in the sense of focusing on behaviors in which anyone within the population can engage or limiting the scope of the population who might be the focus of a TTM study and intervention strategy. For example, active transportation (walking or biking) is not an easy option for physically impaired individuals or for those living in climates with inclement weather conditions or in places with unsafe trail or road conditions. Purchasing organic food is not an easy option for those with fewer financial resources (where organic food is costlier than the conventional choice) or for whom the availability of organic food is limited (e.g., those who live in "food deserts").

There are two potential ways to overcome this challenge and increase the inclusivity of the target behaviors. First would be to consider the goal of the proposed behavior in light of the audience. The target behaviors should be chosen with the surrounding community in mind. One could consider the ultimate goal of the recommended behavior and think through alternative behaviors that would still align with that goal. Offering the audience multiple behavioral options to meet the larger goal could broaden the audience. However, it comes with its own drawbacks as the TTM is more powerful when it is focused on one behavior at a time. The second solution would be for Z/A to partner with other organizations in the community. Utilizing community resources that already exist may help to reduce barriers and increase accessibility. This has the additional benefit of leading to a community-wide change as multiple organizations within the community can pool their resources to accomplish more systematic changes. The challenge with this comes with the amount of time and energy required to develop and foster such partnerships.

Based on this review of the literature, and combined with our own direct experiences as practitioners, we believe that Z/A and other biodiversity conservation institutions can usefully explore application of the TTM to supporting specific PEB. We discuss these applications in the following section.

3.5 | TTM applications in zoo and aquarium settings

As discussed in the prior section, there is little peer-reviewed, empirical research that explicitly has applied a TTM theoretical and methodological approach to understanding and facilitating PEB, and even fewer that uses this model within a Z/A setting. One exception was a study at Disney's Animal Kingdom (Dierking et al., 2004) which categorized visitors based on stages of change to compare behavior intention change before and after a visit to a specific location in the park. One of the important findings of this study was that there were more visitors in the preparation stage that entered the area than any of the other stages. The educational materials and interventions within the area were processes that were better suited for individuals in the precontemplation and contemplation stages. When looking at differences in behavioral intentions among visitors in each stage, differences were not as significant as hypothesized, which could be related to the fact that the stages and processes did not align (Dierking et al., 2004). This study demonstrated one application of the TTM within zoo and aquarium settings: its use as an evaluation tool. Stages of change for a specific behavior can be explored both before and after a program to determine if the intervention resulted in movement to a later stage for measuring behavioral outcomes. If a program is using processes of change that are best suited for one stage, but most visitors are in a different stage, then the effectiveness of the intervention will likely not be as high as intended. By evaluating the stages of participants before a program, educators can ensure that their program is meeting the needs of the audience and make any necessary changes to the educational interventions. Evaluating participants' stages following a program can help Z/A to measure if their interventions facilitated participants' movement through the stages of change toward the desired behavioral goal.

The TTM can also help to guide decisions about which educational strategies to use. According to the TTM, the effectiveness of the educational strategies used, or the processes of change, are dependent on the stage of change of the audience. Different processes will work better for individuals in different stages of change. Therefore, by exploring the common stages of change for the audiences of Z/A programs, institutions can be deliberate in choosing the processes that will influence the conservation behaviors that are likely to produce the greatest sustainability and conservation outcomes. Thus, the TTM has value as a front-end evaluation tool for designing educational programs as well as for evaluating current programming and interpretation. Zoos are effective at raising awareness and informing visitors about wildlife and

conservation (Ballantyne et al., 2007; Clayton et al., 2017; Mony & Heimlich, 2008), or building empathy and stimulating emotional responses to wildlife and conservation (Powell & Bullock, 2014; Young et al., 2018). People expect to be educated at Z/A and rate education as a critical activity (Roe et al., 2014). It is well documented that people can learn at Z/A (Falk et al., 2007; Moss et al., 2015; Packer & Ballantyne, 2010). However, techniques to increase awareness and knowledge fall under the recognizing (consciousness raising) process of change. Therefore, this process is useful at moving people through the early stages of change (precontemplation to contemplation) and less useful in encouraging movement to the later stages of change (J. O. Prochaska et al., 1992). Because an ultimate goal of environmental education within Z/A is to influence PEB, conservation educators need to utilize other processes of change that align with additional stages of change. Evaluating programs will allow Z/A to explore which stage of change most of their visitors are in for the target behavior, and determine which processes of change their engagement programs include.

The TTM can also be used to help decide which behaviors to promote in programming. A simple survey can be used to explore which stages of change people are in for each behavior of interest. If there is one behavior which the majority of participants are not interested in doing, and another which the majority of participants are in contemplation or preparation, it may make sense to focus on the behavior that shows more opportunity for uptake. For example, Woodland Park Zoo invited visitors to use a card-sort activity which allowed staff to identify stage of change for a variety of bird-friendly conservation behaviors. The activity identified one behavior, keeping cats indoors, as very polarizing, with most participants always doing this already or having no interest in this behavior. The activity identified other behaviors that had more people in the "movable middle" (Personal communication, Mary Jackson, March 10, 2021). Intentionally targeting a behavior with more individuals in the "movable middle" may be a more valuable use of educational resources than targeting a behavior that has high levels of resistance. The behavior selection process can be supplemented by an analysis of the relative benefits of each behavior. Balancing the knowledge of which behavior people will likely be facilitated in doing with the behavior that has the greatest environmental value will result in a higher overall impact. Similarly, a front-end evaluation using the stages of change can identify whether a majority of visitors are already doing the behavior. Staff might then decide to support maintenance of the behavior, or switch focus to a behavior that has a high number of individuals in preparation or contemplation.

The TTM construct of decisional balance is also important to consider in a front-end evaluation. Interviewing individuals from each stage of change can be a valuable way of identifying barriers to a behavior, as well as the motivations. Conducting these interviews with people from different stages of change is important because each stage of change may have different barriers and motivations. A barrier for someone in precontemplation may not be a barrier for someone in action. For example, when interviewing people in different stages of change about barriers and motivations, precontemplators described time as a barrier with more frequency than those in the action stage (Nageotte, 2019). Once barriers have been identified, programs can target ways to reduce them. Similarly, motivators can be identified and explicitly discussed during education programming. For example, when designing a program to encourage zoo visitors to keep cats indoors at night, MacDonald (2015) found that zoo visitors tended to be more motivated by thinking about the health and safety of the cat as opposed to the protection of native wildlife. Thus, this information was emphasized in the program (MacDonald, 2015). Although that study was based on persuasive communication as opposed to the TTM, the concept of pointing out motivators for a behavior is consistent across both.

Self-efficacy, the final construct of the TTM, measures the confidence an individual has in the behavior (Bandura, 1977). While there are studies that measure relationships between self-efficacy and various PEBs (e.g., Lauren et al., 2016; Loy et al., 2020), none were found that are specific to a Z/A setting. It would be valuable to design and evaluate programs aimed to increase self-efficacy for PEBs in Z/A visitor, especially when examined in conjunction with other TTM constructs.

We present here (Table 3) the processes of change, with specific examples of how each process could be applied in a Z/A setting. Many processes of change examples are in the context of in-person programming. When Z/A educators can interact with program participants on a personal level, it allows them the opportunity to gauge their stage of change through embedded assessments, and personalize the processes of change used in that interaction. It is more challenging in large group demonstrations or with static signs or displays. However, this challenge can be overcome if these interpretive experiences include engagement via a simple app or other interactive method as well as multiple processes from multiple stages of change. For example, many exhibits exemplify the TTM's Recognizing process of change by including information about a conservation issue and associated behaviors that participants can take to contribute to improved conservation and sustainability outcomes. Some may also include imagery designed to promote emotional arousal regarding the conservation issues and associated behaviors (reacting). These are both processes that are effective at moving individuals from precontemplation to contemplation. These signs may be supplemented with Committing, a process useful for people in contemplation. An example of this might be a touch screen with a way for individuals to make a pledge. Signs may also include information on ways to replace the new behavior for the old one, which can help those in preparation and action. One key caveat is that these processes will only work if individuals read the signs. Z/A visitors do not spend long amounts of time interacting with interpretive elements (Moss et al., 2010). This represents one limitation of the TTM as it would require visitors to engage with the interpretive materials. Using a gamified app could facilitate improved engagement.

4 | FUTURE RESEARCH

Applied research could usefully include design, delivery, and evaluation of TTM-based intervention programs to support specific PEB within particular contexts and populations. This could be structured

TABLE 3 TTM processes of change, with examples in a zoo/aquarium setting

Process of change	Examples of process in a zoo/aquarium setting
Recognizing	On grounds interpretation experience where visitors interact with an educator who explains how gorillas are losing habitat due to coltan mining for electronics and asks visitors to help gorillas by spreading the word on social media about recycling cell phones (J. Wilson, personal communication, May 1, 2021)
Reacting	Demonstration with marine wildlife that shows how they are affected by plastic entanglement and how recycling or reducing plastic use can save marine animals to evoke empathy and concern about the need for reducing plastic use (Mellish et al., 2016)
Re-evaluating (other)	Activity for zoo visitors to calculate their ecological footprint to see their personal impact on the environment based on their daily habits (Detroit Zoo, 2020)
Re-evaluating (self)	Aligning messages about climate change to tested values to prime the audience for the content in a way that will appeal to them (Bales et al., 2015)
Realizing	Providing emails and newsletters to members that include conservation tips and actions that people can take (Nageotte, 2019)
Committing	Asking people to sign pledges to commit to a behavior after a program (MacDonald, 2015)
Reaching out	A young professionals' group for like-minded individuals to learn, network, and engage in conservation activities (Swindle & Grose, 2019)
Rewarding	During the school year, groups of students create projects that lead to direct conservation actions. They gain small rewards during project milestones. Each project is judged at the end of the year with the winning projects receiving a monetary prize (Waldron, 2020)
Replacing	An interpretation program asks zoo visitors to replace regular coffee consumption with shade-grown coffee to reduce habitat destruction in South America and support conservation of migratory birds (Smithsonian's National Zoo & Conservation Biology Institute, n.d.)
Restructuring	Ceasing sales of single-use plastic water bottles, replacing them with reusable water bottles (Wallace, 2017)

Abbreviation: TTM, Transtheoretical Model.

as application of a TTM-based theoretical and methodological approach alone or combined with elements of the CBSM model. Interventions could focus on specific PEB, such as responsible purchasing, energy use, and habitat conservation.

One very intriguing focus of research would be on the civic engagement dimension of PEB. This PEB aspect is of particular interest because adoption of public policy that creates structural fixes—the contexts that shape human behavior—requires public support (Heberlein, 2012; Stern, 2000b) and also yields systems-level change that can facilitate PEB, at a population scale. Future research could explore the specific policy support and civic engagement behaviors that could be facilitated through TTM-based assessment and interventions. More in-depth research examining the role of helping relationships in facilitating change would also be of interest.

5 | CONCLUSION

The primary opportunities for improved conservation and sustainability outcomes are through changing human behavior. Z/A and other public-facing biodiversity conservation institutions offer an important space for facilitating behavior change. We have focused, in this review, on examining common behavior change models within the field as well as the TTM, which is a widely regarded model within the health fields and, recently, in the fields of environmental and leadership studies, with new research applying the TTM specifically in a zoo setting. We have discussed several critiques of the TTM and rebuttals to those critiques. We have also explored related questions regarding the model and presented examples of TTM applications in a zoo setting. Our objective has been to introduce the possibility of applying the TTM to facilitating PEB in Z/A and other biodiversity conservation public-facing institutional settings. We remain impressed by the potential of the TTM to address a critical question within the conservation psychology research field concerning PEB: what specific tools to employ and when.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

Abrash Walton, A. (2018). Positive deviance and behavior change: A research methods approach for understanding fossil fuel divestment. *Energy Research and Social Science*, *45*, 235–249. https://doi.org/10.1016/j.erss.2018.07.003

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179–211. https://doi.org/10.4135/9781412952576.n208

Ardoin, N., Heimlich, J., Braus, J., & Merrick, C. (2013). *Influencing conservation action: What research says about environmental literacy, behavior, and conservation results*. National Audubon Society.

Bales, S. N., Sweetland, J., & Volmert, A. (2015). *How to talk about oceans and climate change: A frameworks MessageMemo*. FrameWorks Institute.

Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. *Environmental Education Research*, *13*(3), 367–383.

Brug, J., Kremers, S., Conner, M., Harre, N., McKellar, S., & Whitelaw, S. (2005). The Transtheoretical Model and stages of change: A critique—Observations by five Commentators on the paper by Adams, J. and White, M. (2004) Why don't stage-based activity promotion interventions work? *Health Education Research*, *20*(2), 244–258.

Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication*, *25*(8), 661–669. https://doi.org/10.1080/10410236.2010.521906

Carrigan, M., Moraes, C., & Leek, S. (2011). Fostering responsible communities: A community social marketing approach to sustainable living. *Journal of Business Ethics*, *100*, 515–534. https://doi.org/10.1007/s10551-010-0694-8

Clayton, S., & Myers, G. (2009). *Conservation psychology: Understanding and promoting human care for nature*. Wiley-Blackwell.

Clayton, S., Prévot, A., Germain, L., & Saint-Jalme, M. (2017). Public support for biodiversity after a zoo visit: Environmental concern, conservation knowledge, and self-efficacy. *Curator: The Museum Journal*, *60*(1), 87–100.

Corbett, J. B. (2005). Altruism, self-interest, and the Reasonable Person Model of environmentally responsible behavior. *Science communication*, *26*(4), 268–389.

Detroit Zoo. (2020, August 17). *Educational lesson: Ecological footprints 1* [Video]. YouTube. https://www.youtube.com/watch?v=40uQQh6jWtY

DiClemente, C. C. (2005). A premature obituary for the Transtheoretical model: A response to West (2005). *Addiction*, *100*, 1046–1048. https://doi.org/10.1111/j.1360-0443.2005.01138.x

Dierking, L. D., Adelman, L. M., Ogden, J., Lehn-Hardt, K., Miller, L., & Mellen, J. D. (2004). Using a behavior change model to document the impact of visits to Disney's Animal Kingdom: A study investigating intended conservation action. *Curator*, *47*(3), 322–343.

Falk, J. H., Reinhard, E. M., Vernon, C. L., Bronnenkant, K., Deans, N. L., & Heimlich, J. E. (2007). *Why zoos & aquariums matter: Assessing the impact of a visit*. Association of Zoos & Aquariums.

Hall, K. L., & Rossi, J. S. (2008). Meta-analytic examination of the strong and weak principles across 48 health behaviors. *Preventive Medicine*, *46*(3), 266–274. https://doi.org/10.1016/j.ypmed.2007.11.006

Heberlein, T. A. (2012). *Navigating environmental attitudes*. Oxford University Press.

Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: A literature review. *Environmental Education Research*, *14*(3), 215–237. https://doi.org/10.1080/13504620802148881

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of responsible environmental behaviors: A meta analysis. *Journal of Environmental Education*, *18*(2), 1–8.

Howell, R. A. (2014). Using the transtheoretical model of behavioural change to understand the processes through which climate change films might encourage mitigation action. *International Journal of Sustainable Development*, *17*(2), 137–159. https://doi.org/10.1504/IJSD.2014.061778

Janis, I. L., & Mann, L. (1977). *Decision making: A psychological analysis of conflict, choice, and commitment*. Free Press.

Kaplan, S. (2000). Human nature and environmentally responsible behavior. *Journal of Social Issues*, *56*(3), 491–508.

Lauren, N., Fielding, K. S., Smith, L., & Louis, W. R. (2016). You did, so you can and you will: Self-efficacy as a mediator of spill-over from easy to more difficult pro-environmental behavior. *Journal of Environmental Psychology*, *48*, 191–199.

Levesque, D. A., Prochaska, J. M., & Prochaska, J. O. (1999). Stages of change and integrated service delivery. *Consulting Psychology Journal: Practice and Research*, *51*(4), 226–241. https://doi.org/10.1037/1061-4087.51.4.226

Loy, L. S., Hamann, K. R. S., & Reese, G. (2020). Navigating through the jungle of information. Informational self-efficacy promotes climate change-related media exposure, knowledge, and behavior. *Climate Change*, *163*, 2097–2116.

Luttrell, A., & Sawiki, V. (2020). Attitude strength: Distinguishing predictors versus defining features. *Social and Personality Psychology Compass*, *15*(2), 1–16.

MacDonald, E. (2015). Quantifying the impact of Wellington Zoo's persuasive communication campaign on post-visit behavior. *Zoo Biology*, *34*, 163–169. https://doi.org/10.1002/zoo.21197

Mair, J., & Laing, J. H. (2013). Encouraging pro-environmental behavior: The role of sustainability-focused events. *Journal of Sustainable Tourism*, *21*(8), 1113–1128.

McKenzie-Mohr, D. (2000). Fostering sustainable behavior through community-based social marketing. *American Psychologist*, *55*(5), 531–537.

Mellish, S., Pearson, E. L., Sanders, B., & Litchfield, C. A. (2016). Marine wildlife entanglement and the Seal the Loop initiative: A comparison of two free-choice learning approaches on visitor knowledge, attitudes and conservation behaviour. *International Zoo Yearbook*, *50*, 129–154. https://doi.org/10.1111/izy.12132

Mellish, S., Ryan, J. C., Pearson, E. L., & Tuckey, M. R. (2018). Research methods and reporting practices in zoo and aquarium conservation-education evaluation. *Conservation Biology*, *33*(1), 40–52. https://doi.org/10.1111/cobi.13177

Miller, W. R., & Rollnick, S. (2002). *Motivational interviewing: Preparing people for change* (2nd ed.). The Guilford Press.

Monroe, J. T., Lofgren, I. E., Sartini, B. L., & Greene, G. W. (2015). The Green Eating Project: Web-based intervention to promote environmentally conscious eating behaviours in US university students. *Public Health Nutrition*, *18*(13), 2368–2378.

Mony, P. R. S., & Heimlich, J. E. (2008). Talking to visitors about conservation: Exploring message communication through docent-visitor interactions at zoos. *Visitor Studies*, *11*(2), 151–162. https://doi.org/10.1080/10645570802355513

Moss, A., Esson, M., & Francis, D. (2010). Evaluation of a third-generation exhibit in relation to visitor behavior and interpretation use. *Journal of Interpretation Research*, *15*(2), 11–28.

Moss, A., Jensen, E., & Gusset, M. (2015). Evaluating the contribution of zoos and aquariums to Aichi biodiversity target 1. *Conservation Biology*, *29*(2), 537–544. https://doi.org/10.1111/cobi.12383

Mundorf, N., Redding, C. A., & Paiva, A. L. (2018). Sustainable transportation attitudes and health behavior change: Evaluation of a brief stage-targeted video intervention. *International Journal of Environmental Research and Public Health*, *15*, 150. https://doi.org/10.3390/ijerph15010150

Nageotte, N. (2019). *Evaluating various conservation behaviors in zoo visitors: A mixed methods study* (Publication No. 27670955) (Doctoral dissertation, Indiana University). ProQuest Dissertations Publishing.

Norcross, J. C., Loberg, K., & Norcross, J. (2013). *Changeology: 5 steps to realizing your goals and resolutions*. Simon & Schuster.

Osbaldiston, R. (2013). Synthesizing the experiments and theories of conservation psychology. *Sustainability*, *5*(6), 2770–2795. https://doi.org/10.3390/su5062770

Osbaldiston, R., & Schott, J. P. (2012). Environmental sustainability and behavioral science: Meta-analysis of proenvironmental behavior experiments. *Environment and Behavior*, *44*, 257–299.

Packer, J., & Ballantyne, R. (2010). The role of zoos and aquariums in education for a sustainable future. *New Directions for Adult and Continuing Education*, *2010*(127), 25–34. https://doi.org/10.1002/ace.378

Powell, D. M., & Bullock, E. V. (2014). Evaluation of factors affecting emotional responses in zoo visitors and the impact of emotion on conservation mindedness. *Anthrozoös*, *27*(3), 389–405. https://doi.org/10.2752/175303714X13903827488042

Prochaska, J. M. (2000). A transtheoretical model for assessing organizational change: A study of family service agencies' movement to time-limited therapy. *Families in Society*, *81*(1), 76–84. https://doi.org/10.1606/1044-3894.1095

Prochaska, J. M., Levesque, D. A., Prochaska, J. O., Dewart, S. R., & Wing, G. R. (2001). Mastering change: A core competency for employees. *Brief Treatment and Crisis Intervention*, *1*(1), 7–15. https://doi.org/10.1093/brief-treatment/1.1.7

Prochaska, J. M., Mauriello, L. M., Sherman, K. J., Harlow, L., Silver, B., & Trubatch, J. (2006). Assessing readiness for advancing women scientists using the transtheoretical model. *Sex Roles*, *54*, 869–880. https://doi.org/10.1007/s11199-006-9053-8

Prochaska, J. O. (2006). Moving beyond the Transtheoretical Model. *Addiction*, *101*, 768–774. https://doi.org/10.1111/j.1360-0443.2006.01404.x

Prochaska, J. O. (2008). Decision making in the transtheoretical model of behavior change. *Medical Decision Making*, *28*(6), 845–849. https://doi.org/10.1177/0272989X08327068

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, *47*(9), 1102–1114.

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion*, *12*(1), 38–48.

Prochaska, J. O., Velicer, W. F., Rossi, J. S., Goldstein, M. G., Marcus, B. H., Rakowski, W., Fiore, C., Harlow, L. L., Redding, C. A., & Rosenbloom, D. (1994). Stages of change and decisional balance for 12 problem behaviors. *Health Psychology*, *13*(1), 39–46.

Redding, C. A., Mundorf, N., Kobayashi, H., Brick, L., Horiuchi, S., Paiva, A. L., & Prochaska, J. O. (2014). Sustainable transportation stage of change, decisional balance, and self-efficacy scale development and validation in two university samples. *International Journal of Environmental Health Research*, *25*(3), 241–253. https://doi.org/10.1080/09603123.2014.938025

Robertson, J. L., & Barling, J. (2013). Greening organizations through leaders' influence on employees' pro-environmental behaviors. *Journal of Organizational Behavior*, *34*(2), 176–194. https://doi.org/10.1002/job.182

Roe, K., McConney, A., & Mansfield, C. F. (2014). The role of zoos in modern society—A comparison of zoos' reported priorities and what visitors believe they should be. *Anthrozoös*, *27*(4), 529–541. https://doi.org/10.2752/089279314X14072268687808

Rosenstock, I. M. (1974). The health belief model and preventive health behavior. *Health Education Monographs*, *2*(4), 354–386. https://doi.org/10.1177/109019817400200405

Salafsky, N. (2003). Making conservation psychology relevant to practitioners. *Human Ecology Review*, *10*(2), 174–176.

Saunders, C. D. (2003). The emerging field of conservation psychology. *Human Ecology Review*, *10*(2), 137–149.

Schultz, P. W. (2011). Conservation means behavior. *Conservation Biology*, *25*(6), 1080–1083. https://doi.org/10.1111/j.1523-1739.2011.01766.x

Schultz, P. W. (2013). Strategies for promoting pro-environmental behavior: Lots of tools but few instructions. *European Psychologist*, *19*(2), 107–117. https://doi.org/10.1027/1016-9040/a000163

Shaw, B. R., Radler, B. T., & Haack, J. (2011). Exploring the utility of the stage of change model to promote natural shorelines. *Lake and Reservoir Management*, *27*(4), 310–320.

Smith, J. R., Witherington, B., Heimlich, J. E., Lindborg, R. J., Neidhardt, E., & Savage, A. (2019). Public sea turtle watches serve as effective environmental education. *Environmental Education Research*, *25*(2), 292–308.

Smithsonian's National Zoo & Conservation Biology Institute. (n.d.). Bird friendly coffee: Proudly serving biodiversity. https://nationalzoo.si.edu/migratory-birds/bird-friendly-coffee

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, *29*(3), 309–317. https://doi.org/10.1016/j.jenvp.2008.10.004

Stern, P. C. (2000a). Psychology and the science of human-environment interactions. *American Psychologist*, *55*(5), 523–530. https://doi.org/10.1037/0003-066x.55.5.523

Stern, P. C. (2000b). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, *56*(3), 407–424. https://doi.org/10.1111/0022-4537.00175

Stern, P. C. (2003). How can conservation psychology become influential? *Human Ecology Review*, *10*(2), 177–179.

Stern, P. C. (2011). Contributions of psychology to limiting climate change. *American Psychologist*, *66*(4), 303–314. https://doi.org/10.1037/a0023235

Swindle, K. J., & Grose, J. (2019, May 8). *Have you heard about The Herd? Cleveland Zoological Society*. https://www.clevelandzoosociety.org/z/2019/05/08/have-you-heard-about-the-herd

Waldron, K. (2020). Philadelphia Zoo Albert M. Greenfield Foundation UNLESS™ Contest. [AZA Education Award Application]. https://www.aza.org/education-award-winners

Wallace, J. (2017, August 1). *Houston zoo eliminates plastic water bottles*. *Houston Zoo*. https://www.houstonzoo.org/blog/houston-zoo-eliminates-plastic-water-bottles/

Weller, K. E., Greene, G. W., Redding, C. A., Paiva, A. L., Lofgren, I., Nash, J. T., & Kobayashi, H. (2014). Development and validation of green eating behaviors, stage of change, decisional balance, and self-efficacy scales in college students. *Journal of Nutrition Education and Behavior*, *46*(5), 324–333. https://doi.org/10.1016/j.jneb.2014.01.002

West, R. (2005). Time for a change: Putting the transtheoretical (stages of change) model to rest. *Addiction*, *100*(8), 1036–1039. https://doi.org/10.1111/j.1360-0443.2005.01139.x

West, R. (2006). The transtheoretical model of behaviour change and the scientific method. *Addiction*, *101*(6), 774–778. https://doi.org/10.1111/j.1360-0443.2006.01502.x

Young, A., Khalil, K. A., & Wharton, J. (2018). Empathy for animals: A review of the existing literature. *Curator: The Museum Journal*, *61*(2), 327–343.

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