CONTRIBUTED PAPER

Co-designing behavior change interventions to conserve biodiversity

Matthew J. Bowie¹ | Timo Dietrich² | Phillip Cassey¹ | Diogo Veríssimo³,⁴

¹School of Biological Sciences, The University of Adelaide, Adelaide, South Australia, Australia
²Social Marketing @ Griffith, Griffith Business School, Griffith University, Brisbane, Queensland, Australia
³Department of Zoology, University of Oxford, Oxford, UK
⁴Institute for Conservation Research, San Diego Zoo Global, Escondido, California

Abstract

Many threats to biodiversity are the result of human actions, which means that changing human behavior can positively alter the trajectory of our current biodiversity crisis. While there is an increasing number of behavior change interventions being implemented in biodiversity conservation, their design is rarely informed by the people they try to influence, thereby lowering the probability of success. Building successful interventions requires substantial audience research, but this can be challenging for conservation projects with perennially limited time and resources. Here, we critically discuss co-design as a useful and effective approach for gathering audience insights relatively quickly, allowing conservation practitioners to integrate end-user voices when they would otherwise be excluded from intervention design. Specifically, we present a seven-step co-design process, providing an outline and guidance for how to generate more user-centric intervention ideas and transform them into feasible prototype interventions. Further, we show how we applied this seven-step process with coffee consumers in a sustainable conservation context. This study outlines contributions that showcase the value of user-centered design approaches to behavior change interventions for biodiversity conservation.

Keywords

behavior change, biodiversity change, co-design, coffee, conservation, consumer behavior, interventions, sustainable

1 INTRODUCTION

Most threats to biodiversity are directly or indirectly the result of human actions (Schultz, 2011; Wright et al., 2015). This also means that changing human behavior has the power to positively alter the trajectory of our current biodiversity crisis (Amel, Manning, Scott, & Koger, 2017; Veríssimo, 2013; Weber, 2017). Whether through direct conservation action or indirectly through changes in our consumer choices, we can individually and collectively create positive impacts for our natural environment (Amel et al., 2017). Importantly, the collective accumulation of small changes by many people can result in profound impact (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009). Despite these intrinsic links, conservation is still relatively new to the behavioral sciences, with increasing calls to better integrate these and other social sciences with conservation research.
practice (Bennett et al., 2017; Reddy et al., 2017; Wright et al., 2015).

The past few years have seen rising interest, acceptance, and use of behavior change disciplines such as social marketing, behavioral economics, and behavioral psychology (Bennett et al., 2017; Daily et al., 2009; Reddy et al., 2017; Selinske et al., 2018; Verissimo, 2019). Despite some environmental applications (e.g., Clayton, Litchfield, & Geller, 2013; McKenzie-Mohr, Lee, Kotler, & Schultz, 2011), these disciplines have been predominantly used in social and health practice (French, Blair-Stevens, McVey, & Merritt, 2010; Truong, 2014), with far fewer explicit examples within conservation (for further discussion see: Clayton et al., 2013; Cowling, 2014; David et al., 2019; Reddy et al., 2017; Selinske et al., 2018; Sterling et al., 2017). A challenge for applying these disciplines to conservation is that the benefits of changing behaviors to conserving biodiversity are often only realized after several years, at the scale of communities or regions, and often accrue only indirectly to the target audience through complex causal links (Verissimo et al., 2018). Yet, while there is an increasing number of behavior change interventions being implemented, their design is rarely informed by the people they try to influence, thereby lowering the probability of success (Aceves-Martins et al., 2016; Greenfield & Verissimo, 2019; Kubacki, Ronto, Lahtinen, Pang, & Rundle-Thiele, 2017).

Building successful behavior change interventions requires substantial audience research. This can present a challenge for many conservation practitioners who may not be trained in or confident with the appropriate social science methods themselves (Bennett et al., 2017; Robinson, Creasey, Skeats, Coverdale, & Barlow, 2019; Wright et al., 2015). Furthermore, the perennially limited resources and short timelines available to many conservation projects make it often impossible to implement fully fledged consumer research studies (e.g., Verissimo, Vieira, Monteiro, Hancock, & Nuno, 2020). To address some of these challenges, we propose co-design as a nimble approach to assist conservation practitioners create user-centered interventions in a short timeframe with limited resources. This approach will be most useful in situations where input from, and active engagement of, the target audience is important for the desired behavior change to occur.

Here, we aim to: (a) provide critical discussion on co-design, defining the boundaries of when and where this may be more useful to biodiversity conservation; (b) present and expand upon a seven-step co-design process by suggesting how insights generated during co-design can be translated into pilot projects; and (c) show how this process can be applied with end-users in a conservation context.

2 | AN INTRODUCTION TO CO-DESIGN

Co-design focuses on intervention design, innovating solutions that resonate with the audience you are seeking to serve. This approach empowers the target audience by involving them as contributors rather than mere recipients of behavior change interventions, thereby facilitating successful implementation (Dietrich, Trischler, Schuster, & Rundle-Thiele, 2017). Co-design provides practical in-depth qualitative audience insights into individuals’ unique knowledge and needs, more oriented towards the design of solutions than classical social science methods (e.g., questionnaires, interviews, and focus groups; Edvardsson, Meiren, Schäfer, & Witell, 2013, Trischler & Charles, 2019). These classical methods tend to be more descriptive of the target audience, both in demographic and psychographic terms, and in the context around which the target behavior takes place (Verissimo et al., 2020). Furthermore, these methods do not allow for co-creation and are often used as the basis upon which experts determine what intervention to implement (Trischler, Dietrich, & Rundle-Thiele, 2019). Co-design focuses on the people who will be directly affected by a behavior change intervention (Mattelmäki & Sleeswijk Visser, 2011). These people may in some contexts be perfectly positioned to suggest possible solutions that are likely to have a high degree of acceptance among the wider target audience. Co-design participants should be empowered to contribute and feel that their experiences and expertise are valued as this will improve their contributions to the generation of new ideas during the co-design session (Mattelmäki, 2008; Sanders & Stappers, 2008; Trischler et al., 2019). However, many of the people conservation practitioners work with may feel a sense of powerlessness or reduced motivation to contribute to co-design activities. This could be due to the complexity of environmental issues, an increasing disconnect between people and nature, as well as other historical or cultural reasons (Ives et al., 2017; Nisbet, Zelenski, & Murphy, 2009; Whitburn, Linklater, & Abrahamse, 2020). These types of audiences are discussed in marketing and consumer behavior literature as “vulnerable consumers” or “everyday citizens,” which importantly is not an enduring classification of individuals, but context specific consideration that demands thoughtfulness (Baker, Gentry, & Rittenburg, 2005). Research in healthcare service development indeed shows that not all individuals have equal capacity to contribute towards the co-design process due to varying motives for participating and prior experiences (Donetto, Pierri, Tsianakas, & Robert, 2015; Engström & Elg, 2015). It is therefore important to accommodate the unique characteristics of each target audience.
audience. Co-design can be approached with varying degrees of time invested across a number of steps with multiple strategies to engage different stakeholders (Donetto et al., 2015; Mattelmäki & Sleeswijk Visser, 2011). This flexibility alongside the direct focus on potential solutions means co-design can quickly gather audience insights with limited resources.

3 | CONSIDERATIONS FOR INTERVENTION CO-DESIGN IN CONSERVATION

Many behavior change problems require proactive audience engagement and sustained uptake to be successful. Large-scale and long-term consumer research studies can provide the necessary insights, data, and engagement in these situations, yet are often not possible for conservation projects (e.g., Veríssimo et al., 2020). With this in mind, we provide guidance for how conservation practitioners apply co-design to address the challenges of conserving biodiversity. First, the project team needs to be clear about what the desired change in human behavior is and how this will generate mutually beneficial exchanges that both biodiversity and the people enacting change positively respond to. Second, carefully consider the usefulness of user-generated ideas and insights to designing interventions. In some cases, the initial target audience may identify barriers to change that are beyond their, and the project team’s, control (e.g., laws, deeply entrenched cultural or religious beliefs, technological deficiencies). However, this may simply mean that the insights from co-design can be used alongside other types of behavior change such as law reform and technical interventions (Rothschild, 1999; Veríssimo, Sadowsky, & Douglas, 2019). Finally, it is important to recognize that co-design is used to empower the target audience as contributors to intervention design, rather than mere recipients, but outputs from co-design can be used alongside expert advice to inform intervention design.

Co-design approaches can be criticized as being too user centric, ignoring important other stakeholder contributions (Dietrich et al., 2017; Dietrich, Rundle-Thiele, Schuster, & Connor, 2016; Durl, Trischler, & Dietrich, 2017). There are limitations to what can be expected from co-design participants in terms of generating ideas for intervention solutions and these limitations have not been sufficiently discussed in co-design literature. Co-design may not be able to identify target behaviors that need to be changed and could prove challenging to implement with sensitive or illicit behaviors or those that hinge on non-conscious cues and low cognitive load decisions. Furthermore, just because users like an activity or idea does not mean that it is effective in producing the desired behavior change, and vice versa. Ultimately, project teams may need to find a balance between user insights and expert judgement (e.g., evidence base, expert panels) to create behavior change interventions that resonate with the target audience and have a high likelihood of being effective.

Previous co-design processes have not outlined how to take co-design ideas and transform them into feasible pilot projects. This paper contributes to an important gap in the literature, outlining how this can be achieved by drawing from design thinking processes (Brown, 2009; Martin & Martin, 2009; Tschimmel, 2012) to convert intervention ideas generated through co-design one step further and define testable intervention prototypes. Table 1 provides an overview of a seven-step co-design process, developed with everyday citizens in mind (Dietrich et al., 2017; Trischler et al., 2019), with considerations for practitioners wanting to address the challenges of conserving biodiversity. This builds on a previous overview of the original six-step framework (Dietrich et al., 2017) completed for a transformative service research context (Hurley, Trischler, & Dietrich, 2018).

4 | CO-DESIGN IN ACTION

Here, we present an application of the seven-step co-design process to sustainable coffee demand. Coffee agriculture can either decimate or support local biodiversity through different land-use-change and production practices (Buechley et al., 2015; DeFries, Fanzo, Mondal, Remans, & Wood, 2017; Tscharrntke et al., 2015). The coffee industry will need to change to address the challenges of climate change, pests, and disease threatening production areas (Ovalle-Rivera, Läderach, Bunn, Obersteiner, & Schröth, 2015), all while global coffee demand is predicted to more than double by 2050 (Panhuysen & Pierrot, 2018, Sustainable Coffee Sustainable Coffee Challenge, 2018). Co-design could be successfully applied to both supply and demand side behavior change interventions to help address these challenges. Here, we begin to explore the demand-side, as coffee is a buyer-driven globalized commodity, so changes in consumer preferences can result in shifting demands on how coffee is produced. See Supporting Information S1 for expanded background and rationale. Promisingly, younger consumers increasingly appreciate information about the sustainability and ethical sourcing of their coffee (Panhuysen & Pierrot, 2018). So, to better understand how co-design can work, we applied the seven-step process (Trischler et al., 2019) to generate consumer-driven ideas for interventions to change coffee consumer
| Co-design step | Description | Considerations |
|----------------|-------------|----------------|
| **1. Resourcing** | Identify relevant input for co-design workshops to be sourced by project team. Consider ethical implications of desired behavior change on target audience and for those involved in co-design process. Obtain approval(s) by relevant ethical/community board/elders. | Development of in-depth understanding of the issues related to the underlying topic. Identification of specific themes or activities from existing behavior change interventions to inform the development of co-design tools or activities to be used during workshops. |
| **2. Planning** | Collaborate with key stakeholders. Plan next five steps, including scenarios of unexpected events that may arise during facilitation of workshops (e.g., power-dynamics, social anxiety). Note: Planning and recruiting steps can be an iterative process to ensure the needs and interests of multiple stakeholders are appropriately managed to gain support for running the actual co-design activity as well as to address unexpected set-backs in recruitment of participants. | Regular meetings with project team to plan recruiting, sensitizing and facilitating steps. Define desired outcome from co-design workshops, what/how data will be collected, managed, analyzed and reported (e.g., de-identified comments, summary statistics), including reports back to the participants/target audience. Network the co-design workshops and underlying topic to create awareness among relevant stakeholders and the target audience. |
| **3. Recruiting** | Identify target group(s) who are potentially willing to, and capable of contributing new ideas that are appealing to the broader target audience. Consider the type and tone of media, medium(s) and message(s) for recruitment to ensure appropriate for the identified target audience. This can be an iterative process. In cases where initial recruitment strategy does not produce sufficient or appropriate participants, go back to planning an improved recruitment strategy, trying alternate media channels, medium(s) or message(s). | Tap strong networks between target audience and relevant stakeholders, plus project team and relevant stakeholders to identify and recruit participants. Incentivise target audience (where appropriate) by making them aware of the contribution they can make through participation but carefully consider bias. When appropriate, have participants publicly or privately commit (RSVP) to attending your workshop and send multiple friendly reminders. It is likely more people will sign-up than will actually show up. Expect <50% of sign-ups to show up, but be prepared for higher turnout as you will not want to turn away participants. |
| **4. Sensitizing** | Familiarize participants with the underlying topic by allowing them to experience and test existing activities and solutions prior to co-design workshops when possible. For instances where this is not possible, use some combination of images, video, sound or short written descriptions (<50 words) of existing activities and solutions. People understand in a variety of ways so it is important to use a mix of stimuli. | Integrate sensitizing techniques into the co-design workshops in cases where target audience are time-poor or not accessible prior to workshops. Allow participants to “break free” from their everyday life to help them become aware of the specific roles they play, the changes they can make, and positive impacts they can have. Lead and show potential change but do not tell, realisation needs to be honest. |
| **5. Facilitating** | Welcome participants as culturally appropriate. Provide easy access to water, food, toilets or other facilities without the need for participants to ask facilitators for access (balancing power dynamics). | Use tools to reduce the dominance of the facilitator, but at the same time, avoid off-topic discussions. Finding the fine line between close guidance (to ensure progress and outcomes that align with the... |
behavior within a large metropolitan university in Australia. We chose this university-cohort due to the majority of coffee consumers being younger professionals. This allowed us to trial the co-design process with an audience that we anticipated to be more open towards sustainability-based behavior change. The application of the seven steps is described later.

### 4.1 Resourcing

Resourcing for co-design workshops involved sourcing a variety of relevant intervention activities to develop activity booklets (see Supporting Information S2), used in place of activity cards as described in (Dietrich et al., 2017). Twelve intervention activities were chosen...
based on discussions with university coffee suppliers and other stakeholders on what had previously been attempted as well as from literature on sustainable consumerism (e.g., Bolderdijk & Steg, 2015; Campbell-Arvai, Arvai, & Kalof, 2014; Dangelico & Vocalelli, 2017; Sodhi, 2011). While the majority of these interventions have been informed by expert-judgement, they may not be what end-users want, warranting more user-oriented focus to intervention design.

4.2 | Planning

Planning for co-design and behavior change with coffee consumers included discussions and relationship development with university stakeholders and representatives from coffee suppliers. This step included preparation of activity booklets, recruitment materials, room bookings, and application for ethical approval to conduct human research. Two ninety-minute co-design workshops were planned at a centrally located private room on the university campus for participant convenience. One workshop was planned during a regular lunch-break and one immediately after standard work-hours to capture participants with varying availability.

4.3 | Recruiting

All participants needed to be over 18 years old, the age at which a child becomes an adult under general Australian law, and were recruited from within the university population over a two-week period prior to the planned workshop. For each workshop, a separate, private, and free online registration page was created through Eventbrite (eventbrite.com.au). This registration page hosted workshop-specific information and links to relevant consent forms and participant information sheets. To simplify access to these registration pages, a shortened URL and QR-code were generated using freely available online services (bitly.com and qr-code-generator.com). In an attempt to avoid self-selection bias towards environmentally concerned consumers, the recruitment materials did not mention any terms related to environment or sustainability.

Recruitment materials consisted of A4-sized color printed flyers, social media posts, and email announcements (see Supporting Information S3). Over the two-week recruitment period, 400 flyers were strategically placed near major lecture theatres, on notice boards, near coffee retailers, and on the inside of toilet-cubicle doors. A short social media post, including hyperlinks to recruitment pages, was shared by several university-based social media accounts on Instagram, Twitter, and Facebook, including both standard posts but also through Instagram and Facebook stories. A similar 50-word recruitment email, including hyperlinks to recruitment pages, was included in the weekly student and staff news emails sent to all university student and staff accounts. Finally, for every registration, a confirmation email was sent to the participant thanking them for registering to attend but also asking if they could invite a friend or colleague. A total of 78 registrations were recorded for two workshops, with a total of 53 participants attending workshops (68% attendance rate).

4.4 | Sensitizing and facilitating

Sensitizing—i.e., familiarizing participants with underlying topic and potential solutions—was incorporated alongside facilitating into co-design workshops due to time limitations of participants who would need to take time out of their work/study schedule. All 53 co-design participants provided their informed consent to participate at the start of their workshop. To understand the profile of green-consumers, psychographics have been suggested to be more important than demographics (Larson & Farac, 2019). Thus, in the first 10 min of each workshop participants completed a psychographic and demographic questionnaire including the 21-point psychographic Nature Relatedness (NR) Scale (Nisbet et al., 2009) plus six demographic questions (age, gender, education, nationality, postcode, role at university). We chose the NR Scale as a psychographic with good links to sustainable product preference (Nisbet et al., 2009; Zelenski, Dopko, & Capaldi, 2015), but there are other psychographics that could also be used (e.g., The Connectedness to Nature Scale (CNS); Mayer & Frantz, 2004, or The Inclusion of Nature with Self (INS); Schultz, 2002, for further review see Tam, 2013). Participants were provided a brief two-minute verbal overview of the research project before each individual was provided with an activity booklet containing 12 intervention activities (see Supporting Information S2). Participants were given 20–30 min to review all intervention activities and asked to comment on what they liked or disliked about them. The final page of the activity booklet asked participants to list their top and bottom three intervention activities, including why they liked or disliked them the most, with the final option to list a mix of intervention activities they would prefer to receive. During this time facilitators collected and scored NR psychographics. The mean overall NR-score for each participant was used to make groups of between 37 individuals based on high (>3.6), neutral (3.4–3.6), or low (<3.6) mean NR-scores. Once all
participants had completed their individual activity booklets, they were asked to form into these groups. For this group activity, participants were asked to create their ultimate intervention to help sustain coffee through the university. Groups were given 20–30 min to create their interventions on blank sheets of Kraft paper (805 × 565 mm), with marker pens, ballpoint pens, colored pencils, post-it notes, highlighters and use of words and drawings. At the end of this time, each group was asked to present 60-second verbal summaries of their intervention to the entire room, which were filmed.

4.5  Reflecting

4.5.1  Psychographics and demographics

A total of 53 end-user participants commenced across two co-design workshops, however eight participants were excluded from these analyses due to incomplete responses. The remaining 45 participants were aged from 18 to 56 (mean = 25.8 years), 60% female, predominantly university students (48.9% undergraduate, 46.7% post-graduate), identifying themselves from 17 different nationalities, with representation across all five faculties of the university. Overall, participants scored moderately high on the NR Scale (mean = 3.94), with mean NR-perspective and NR-self greater than four out of five, while NR-experience shows a greater spread of scores (Figure 1; see Nisbet et al., 2009 for full explanations of these three NR descriptive labels). During workshops, facilitators used the mean overall NR-score to form groups of participants with similar mean scores. However, a limitation of this method is that participants could reach an equivalent mean overall NR-score with very different responses to individual questions (see Supporting Information S4 for responses to the full 21-point scale).

4.5.2  Individual preferences of existing intervention activities

Rankings of the 12 intervention activities showed clear preferences with four overarching categories emerging, namely and in order of preference: (a) rewards, (b) choice architecture, (c) education, and (d) norms. Below, we expand upon these broad categories:

Rewards

Reward-based interventions, including incentives and taste testing events, were ranked most highly with over half of participants choosing these in their top preference (Figure 2). Participants indicated that rewards and positive experiences are likely to shift their purchasing choices more quickly. Illustrated by participant comments:

Incentives: EU49 “Who doesn’t like getting their coffee cheaper? It is guaranteed that students will go for this, we love saving money, especially when it comes to coffee”, EU01 “Great idea, people like positive reinforcement via rewards”.

Taste testing events: EU09 “Allows people to taste coffee they wouldn’t always try and learn about flavour differences. Demystifies ‘sustainable’ coffee”, EU02 “YES! One of the best ways. Would work like a trial run before properly switching to a sustainable brand, hands on experience”.

Choice architecture

Interventions relating to choice architecture—i.e., the design and impact of how choices are presented to consumers—were the top preference for approximately a third of participants, namely more options and make sustainable default, although the latter was also placed in the bottom preference for a fifth of participants (Figure 2). Comments highlighted the need to retain some freedom of choice, but that too much choice was confusing. These comments also highlighted the belief that default sustainable options are likely to result in significant positive change so long as this does not remove all ability to choose from a range of options:

More options: EU19 “More options = more availability and a large market to choose from, gives one the freedom to experiment [but] confusing about too much to choose from.”, EU13 “More options is a really good idea but it also depends on what options they & how would they taste”.

Make sustainable default: EU51 “This helps the cause of sustainability significantly since everyone, irrespective of their level of awareness, is consuming sustainable coffee”, EU26 “Doesn’t involve thinking, 100% participation rate! Done. Easy. Do this. Love not having to think!”, EU20 “May not be people’s preference. People don’t want to be told what to do”.

FIGURE 1  Distribution of average Nature Relatedness Scale (NR) scores, with mean and standard deviation shown respectively by the point and line within violin plots
**Education**

Education focused interventions, including certified sustainable labelling, sustainable coffee purchasing guide, and an event, showed some support from participants but with no strong preferences. Participants highlighted that these education focused interventions could be paired with rewards or choice architecture focused interventions to increase their likelihood of bringing about informed changes in purchasing behavior.

Certified sustainable labelling: EU22 “you know your coffee is definitely sustainable, simplifies making choices”, EU21 “Clear, simple, allows consumers to make informed choices”.

Sustainable coffee purchasing guide: EU43 “Not likely to read, waste of paper”, EU17 “Knowing how to buy sustainably could help”.

Event: EU15 “Interest will be developed through events”, EU40 “Along with taste testing event, this will spread the word. Peer to peer education”.

**Norms**

Norm-based interventions, including demarketing, prompts, commitments, social norms, and feedback, were ranked lowest, with approximately two-thirds of participants placing demarketing and prompts in their bottom preference (Figure 2). Participants highlighted that negative demarketing messaging or “annoying” reminders are unlikely to shift their coffee choices in the long-term. It also appears that some participants interpreted demarketing—i.e., any attempt to discourage consumers from buying a certain product—as an intervention that would restrict their choice. This is reflected in participant comments:

Demarketing: EU42 “I don’t like that, because it has negative association on me. Why someone can restrict to buy? It is your personal decision. I think it is better highlight benefits of sustainable coffee.”, EU16 “I think focusing on the positives of sustainability is a better method”.

Prompts: EU04 “because people don’t like spam and may ignore/block such messages”, EU12 “Last thing I would want is more messages on my phone”.

Furthermore, norm-based approaches were seen as unrealistic in this scenario, although positive messages could be useful in conjunction with more desirable intervention activities:

Feedback: EU35 “Positive optimism would really help people to come up with better ideas”, EU03 “Might be difficult to implement, especially if you use multiple cafes”.

Social norms: EU44 “It can encourage friends, colleagues, to increase the awareness of environment...
Peer pressure is generally hard way to force people.

Commitments: EU36 “Pledging for a small day to day commodity is not realistic”, EU08 “Pledges and resolutions never work”.

4.5.3 | Group intervention design

Similarly to initial individual preferences, group interventions relied heavily on rewards, with some use of choice architecture and education focused interventions, but far fewer uses of norms (Table 2). Most groups used incentives and taste testing events in conjunction with education and marketing interventions around making informed choices, with multiple groups also highlighting the use of social norms in the form of celebratory endorsement. Although multiple intervention activities were initially included in the group ideation stages, all groups presented only a subset of those activities in their final pitch. There were no clear differences in terms of intervention preferences among groups consisting of participants that scored higher or lower on the NR Scale. Although it was noted that lower NR groups were less engaged and collaborated and communicated less with each other compared to higher NR groups. All groups presented and noted novel ideas, which primarily focused around: (a) raising awareness or education about sustainable coffee; (b) using celebrities to create social norms; as well as (c) other ideas around taxing, storytelling, providing experiences through exchange programs/tours or producing new products with sustainably grown coffee beans.

4.6 | Building for change

A major gap in the Trischler et al. (2019) framework is that the final step does not provide specific or clear advice for how one should go about translating user-generated ideas and insights into actual behavior change interventions. We decided to draw from the design thinking literature (see Brown, 2009; Martin & Martin, 2009; Tschimmel, 2012) to convert the co-design intervention ideas one step further and define testable intervention prototypes. Drawing from the insights and ideation of end-users discussed and reflected on above, we developed two prototype interventions. Conceptualizing testable prototypes is the final stage of this co-design process. Evaluation and reflection on the efficacy of these interventions will form the basis of a future follow-up study. The prototypes and their rational are outlined later.

4.6.1 | Incentives + more options

This first prototype intervention aims to test how financial incentives influence end-user consumer choice by providing an additional sustainable option. This prototype intervention was chosen as it combines two of the most highly preferred intervention activities from the top two categories defined earlier, rewards and choice architecture (Figure 2 and Table 2). More specifically, an additional sustainable coffee option will be provided in a cafe-setting alongside the standard coffee option, but at different prices (Figure 3). Before, during and after each intervention the number of coffee sales will be used to evaluate intervention success, alongside consumer surveys to gather qualitative measures for why they make their coffee choices. This experimental design is a feasible option for the project team with the available resources and stakeholder relationships developed through co-design as well as already existing sustainable coffee on the market.

4.6.2 | Default sustainable + taste testing

This second prototype intervention aims to test how default sustainable options can be implemented while engaging end-user consumers through coffee taste testing events (Figure 4). Again, this prototype incorporates both choice architecture and rewards with default sustainable option and taste testing events being highly preferred intervention activities (Figure 2 and Table 2). Similarly to the previous prototype, sales and surveys will be used to evaluate intervention success. This experimental design is again a feasible option for the project team to implement in the university setting where there are multiple cafes and coffee vending machines on campus that could be used to test this intervention in a natural setting.

4.7 | Limitations and future work for this co-design application

We have shown how the seven-step co-design process has been used to generate prototype interventions from consumer-driven ideas. These two prototype interventions will be tested as part of a future study to evaluate the success of this co-design activity. However, we acknowledge that co-designing with only coffee consumers is not enough to create comprehensive interventions. Future applications of co-design should also work in consultation with wider stakeholder groups to better understand where the most impact can be made in a
| Category (% of groups using category) | Intervention activity | % of groups using intervention activity | De-identified group code (Gp#) and nature relatedness allocation |
|--------------------------------------|-----------------------|----------------------------------------|---------------------------------------------------------------|
|                                     |                       |                                        | Gp1 | Gp2 | Gp3 | Gp4 | Gp5 | Gp6 | Gp7 | Gp8 | Gp9 | Gp10 |
| Rewards (85%)                       | Incentives            | 90                                      | x   | x   | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Taste testing events  | 80                                      | x   | x   | x   | x   | x   | x   | x   | x   | x   | x   |
| Choice architecture (55%)           | Make sustainable default | 50                                      | x   | x   | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | More options          | 60                                      | x   | x   | x   | x   | x   | x   | x   | x   | x   | x   |
| Education (43.3%)                   | Certified sustainable labelling | 50                                      | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Event                 | 60                                      | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Sustainable coffee purchasing guide | 20                                      | x   | x   | x   | x   | x   | x   | x   |
| Norms (16%)                         | Feedback              | 20                                      | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Social norms          | 50                                      | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Commitments           | 10                                      | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Prompts               | 0                                       | x   | x   | x   | x   | x   | x   | x   | x   |
|                                     | Demarketing           | 0                                       | x   | x   | x   | x   | x   | x   | x   | x   |
complex problem like sustainable coffee consumption. In our case, the project team attempted to co-design with coffee suppliers and purchasing staff, but were unable to successfully bring these people together into face-to-face co-design sessions due to inaccessibility and time constraints of potential participants during recruiting. Future co-design work could overcome this by working in conjunction with traditional market research methods or by using technologies such as videoconferencing to bring together various stakeholders in a virtual co-design setting (Archibald, Ambagtsheer, Casey, & Lawless, 2019), but this will no doubt bring new challenges.

**FIGURE 3** Prototype experimental design for an intervention using rewards (financial incentives) and choice architecture (more options) to test how end-user coffee consumer choice can be nudged towards sustainable options.

**FIGURE 4** Prototype experimental design for an intervention using rewards (taste testing events) and choice architecture (default sustainable) to test how end-user coffee consumer choice can be nudged towards sustainable options. Intervention B (provide information but no taste testing) is included to evaluate the impact of prior information before change occurs, which will happen with taste testing prior to change as is intervention C.
5 | THE FUTURE FOR CO-DESIGN IN CONSERVATION

There is still much work that needs to be done to better understand when, where, and how co-design can be best used to help conserve biodiversity. For some conservation issues, the human behaviors that need to change will be largely driven by non-conscious, low-cognitive-load (system 1) decision making, and so may not be particularly open to introspection by co-design participants. Resultantly, co-design may be less useful at producing effective conservation interventions for these smaller, everyday decision-based behaviors. Co-design processes are also likely to struggle with illicit behaviors, so may not apply well to conservation issues driven by illegal behaviors—such as illegal wildlife trade. Conversely, there will be conservation issues largely driven by conscious, high-cognitive-load (system 2) decision making. For these issues, co-design participants could prove to be effective for generating insightful and successful conservation interventions—such as which coffee a roaster or trader buys, or how the farmer grows coffee on their farm. However, more research and real-world applications are needed to properly understand the finalities of applying co-design to conservation.

6 | CONCLUSION

Changing human behavior is complex and building successful interventions requires substantial audience research. For many conservation projects, restrictive timelines and budgets prohibit fully fledged consumer research studies. Co-design is a useful and effective approach for gathering audience insights relatively quickly, allowing end-user voices to be heard when they would otherwise be fully excluded due to perceived lack of time or resources. Specifically, the seven-step co-design process we showcase in this paper provides an outline and guidance for how to generate user-centric intervention ideas and transform them into feasible prototype interventions. Although co-design will not be applicable for every conservation program, we hope this work stimulates conservation practitioners to engage with their target audiences and include their voices in behavior change interventions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Matthew J. Bowie, Timo Dietrich, Phillip Cassey, and Diogo Verissimo developed the initial ideas, Matthew J. Bowie and Timo Dietrich managed the data collection process, Matthew J. Bowie led data analysis, writing, discussion among co-authors, and the submission and publication of the manuscript. All authors: extensively discussed and contributed original ideas, text, and references to the manuscript, agreed on the outline, considerations for conservation practitioners applying the seven-step co-design framework, and contributed to revision and preparation of the final manuscript.

DATA AVAILABILITY STATEMENT

The co-design data from section four have not been made available.

ORCID

Matthew J. Bowie https://orcid.org/0000-0003-0491-2675
Diogo Verissimo https://orcid.org/0000-0002-3519-6782

REFERENCES

Aceves-Martins, M., Llauradó, E., Tarro, L., Moreno-Garcia, C. F., Trujillo Escobar, T. G., Sola, R., & Giralt, M. (2016). Effectiveness of social marketing strategies to reduce youth obesity in European school-based interventions: A systematic review and meta-analysis. Nutrition Reviews, 74, 337–351.
Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: Fostering collective effort toward ecosystem conservation. Science, 356, 275–279.
Archibald, M. M., Ambagtsheer, R. C., Casey, M. G., & Lawless, M. (2019). Using zoom videoconferencing for qualitative data collection: Perceptions and experiences of researchers and participants. International Journal of Qualitative Methods, 18, 1609406919874596.
Baker, S. M., Gentry, J. W., & Rittenburg, T. L. (2005). Building understanding of the domain of consumer vulnerability. Journal of Macromarketing, 25(2), 128–139.
Bennett, N. J., Roth, R., Klain, S. C., Chan, K., Clark, D. A., Cullman, G., … Teel, T. L. (2017). Mainstreaming the social sciences in conservation. Conservation Biology, 31(1), 56–66.
Bolderdijk, J. W., & Steg, L. (2015). Promoting sustainable consumption: The risks of using financial incentives. Lucia A. Reisch & John Thøgersen Handbook of research on sustainable consumption, (328–342). The Lypiatts: Edward Elgar Publishing Limited. https://doi.org/10.4337/9781783471270.00033.

Brown, T. (2009). Change by design: How design thinking creates new alternatives for business and society, New York, NY: HarperCollins Publishers Inc.

Buechley, E. R., Sekercioglu, Ç. H., Atickem, A., Gebremichael, G., Ndungu, J. K., Mahamued, B. A., ... Lens, L. (2015). Importance of Ethiopian shade coffee farms for forest bird conservation. Biological Conservation, 188, 50–60.

Campbell-Arval, V., Arval, J., & Kalof, L. (2014). Motivating sustainable food choices: The role of nudges, value orientation, and information provision. Environment and Behavior, 46(4), 453–475.

Sustainable Coffee Challenge. (2018). Sustainable Coffee Challenge [Online]. Available from www.sustaincoffee.org/.

Clayton, S., Litchfield, C., & Geller, E. S. (2013). Psychological science, conservation, and environmental sustainability. Frontiers in Ecology and the Conservation, II(7), 377–382.

Cowling, R. M. (2014). Let’s get serious about human behavior and conservation. Conservation Letters, 7(3), 147–148.

Daily, G. C., Polasky, S., Goldstein, J., Kareiva, P. M., Mooney, H. A., Pejchar, L., ... Shallenberger, R. (2009). Ecosystem services in decision making: Time to deliver. Frontiers in Ecology and the Environment, 7, 21–28.

Dangelico, R. M., & Vocatelli, D. (2017). “Green marketing”: An analysis of definitions, strategy steps, and tools through a systematic review of the literature. Journal of Cleaner Production, 165, 1263–1279.

David, P., Rundle-Thiele, S., Pang, B., Knox, K., Parkinson, J., & Hussenoeder, F. (2019). Engaging the dog owner community in the design of an effective koala aversion program. Social Marketing Quarterly, 25, 55–68.

DeFries, R. S., Fanzo, J., Mondal, P., Remans, R., & Wood, S. A. (2017). Is voluntary certification of tropical agricultural commodities achieving sustainability goals for small-scale producers? A review of the evidence. Environmental Research Letters, 12, 033001.

Dietrich, T., Rundle-Thiele, S., Schuster, L., & Connor, J. (2016). Co-designing social marketing programs. Journal of Social Marketing, 6, 41–61.

Dietrich, T., Trischler, J., Schuster, L., & Rundle-Thiele, S. (2017). Co-designing services with vulnerable consumers. Journal of Service Theory and Practice, 27, 663–688.

Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Van den Bergh, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. Proceedings of the National Academy of Sciences, 106, 18452–18456.

Donetto, S., Pierri, P., Tsianakas, V., & Robert, G. (2015). Experience-based co-design and healthcare improvement: Realizing participatory design in the public sector. The Design Journal, 18, 227–248.

Durl, J., Trischler, J., & Dietrich, T. (2017). Co-designing with young consumers: reflections, challenges and benefits. Young Consumers.

Edvardsson, B., Meiren, T., Schäfer, A., & Witell, L. (2013). Having a strategy for new service development—does it really matter? Journal of Service Management, 24, 25–44.

Engström, J., & Elg, M. (2015). A self-determination theory perspective on customer participation in service development. Journal of Services Marketing, 29, 511–521.

French, J., Blair-Stevens, C., McVey, D., & Merritt, R. (2010). Social marketing and public health: Theory and practice, Oxford: Oxford University Press.

Greenfield, S., & Verissimo, D. (2019). To what extent is social marketing used in demand reduction campaigns for illegal wildlife products? Insights from elephant ivory and rhino horn. Social Marketing Quarterly, 25, 40–54.

Hurley, E., Trischler, J., & Dietrich, T. (2018). Exploring the application of co-design to transformative service research. Journal of Services Marketing, 32, 715–727.

Ives, C. D., Giusti, M., Fischer, J., Abson, D. J., Kaniecki, K., Dorninger, C., ... Martin-López, B. (2017). Human–nature connection: A multidisciplinary review. Current Opinion in Environmental Sustainability, 26, 106–113.

Kubacki, K., Ronto, R., Lahtinen, V., Pang, B., & Rundle-Thiele, S. (2017). Social marketing interventions aiming to increase physical activity among adults. Health Education.

Larson, R. B., & Farac, J. M. (2019). Profiling Green consumers. Social Marketing Quarterly, 25, 275–290.

Martin, R., & Martin, R. L. (2009). The design of business: Why design thinking is the next competitive advantage, Boston, MA: Harvard Business Press.

Mattelmäki, T. (2008). Probing for co-exploring. Co-Design, 4, 65–78.

Mattelmäki, T. & Sleeswijk Visser, F. Lost in co-X: Interpretations of co-design and co-creation. 4th world conference on design research (IASDR 2011). Delft, The Netherlands, 2011.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. Journal of Environmental Psychology, 24, 503–515.

McKenzie-Mohr, D., Lee, N. R., Kotler, P., & Schultz, P. W. (2011). Social marketing to protect the environment: What works, London: Sage Publications. http://dx.doi.org/10.4135/9781483349466.

Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The nature relatedness scale: Linking individuals' connection with nature to environmental concern and behavior. Environment and Behavior, 41, 715–740.

Panhuysen, S., & Pierrot, J. (2018). Coffee barometer 2018, : . Conservation International, COSA, Oxfam Wereldwinkels, Solidaridad. https://www.hivos.org/assets/2018/06/Coffee-Barometer-2018.pdf.

Raddy, S. M., Montambault, J., Masuda, Y. J., Keenan, E., Butler, W., Fisher, J. R., ... Gneezy, A. (2017). Advancing conservation by understanding and influencing human behavior. Conservation Letters, 10, 248–256.

Robinson, B. S., Creasey, M. J., Skeats, A., Coverdale, L., & Barlow, A. (2019). Global survey reveals a lack of social market approach to environmental conservation by understanding and influencing human behavior. Social Marketing Quarterly, 25, 9–25.

Rothschild, M. L. (1999). Carrots, sticks, and promises: A conceptual framework for the management of public health and social issue behaviors. Journal of Service Management, 63, 24–37.
Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. Co-Design, 4, 5–18.
Schultz, P. W. (2002). Inclusion with nature: The psychology of human-nature relations. P. Schmuck & W.P. Schultz In Psychology of Sustainable Development, (61–78). Boston, MA: Springer. https://doi.org/10.1007/978-1-4615-0995-0_4.
Schultz, P. W. (2011). Conservation means behavior. Conservation Biology, 25, 1080–1083.
Selinske, M., Garrard, G., Bekessy, S., Gordon, A., Kusmanoff, A., & Fidler, F. (2018). Revisiting the promise of conservation psychology. Conservation Biology, 32, 1464–1468.
Sodhi, K. (2011). Has marketing come full circle? Demarketing for sustainability. Business strategy series.
Sterling, E. J., Betley, E., Sigouin, A., Gomez, A., Toomey, A., Cullman, G., ... Blair, M. (2017). Assessing the evidence for stakeholder engagement in biodiversity conservation. Biological Conservation, 209, 159–171.
Tam, K.-P. (2013). Concepts and measures related to connection to nature: Similarities and differences. Journal of Environmental Psychology, 34, 64–78.
Trischler, J., & Charles, M. (2019). The application of a service ecosystems lens to public policy analysis and design: Exploring the frontiers. Journal of Public Policy & Marketing, 38, 19–35.
Trischler, J., Dietrich, T., & Rundle-Thiele, S. (2019). Co-design: From expert- to user-driven ideas in public service design. Public Management Review, 21, 1595–1619.
Truong, V. D. (2014). Social marketing: A systematic review of research 1998–2012. Social Marketing Quarterly, 20, 15–34.
Tscharntke, T., Milder, J. C., Schroth, G., Clough, Y., DeClerck, F., Waldron, A., ... Ghazoul, J. (2015). Conserving biodiversity through certification of tropical agroforestry crops at local and landscape scales. Conservation Letters, 8, 14–23.
Tschimmel, K., Design Thinking as an effective Toolkit for Innovation. ISPIM Conference Proceedings 2012. The International Society for Professional Innovation Management (ISPIM), 1.
Verissimo, D. (2013). Influencing human behaviour: An underutilised tool for biodiversity management. Conservation Evidence, 10, 29–31.
Verissimo, D. (2019). The past, present, and future of using social marketing to conserve biodiversity. Los Angeles, CA: SAGE Publications Sage CA.
Verissimo, D., Bianchessi, A., Arrivillaga, A., Cadiz, F. C., Mancao, R., & Green, K. (2018). Does it work for biodiversity? Experiences and challenges in the evaluation of social marketing campaigns. Social Marketing Quarterly, 24(1), 18–34.
Verissimo, D., Sadowsky, B., & Douglas, L. (2019). Conservation marketing as a tool to promote human-wildlife coexistence. In Human-wildlife interactions: Turning conflict into coexistence, Conservation Biology, (pp. 335–358). Cambridge: Cambridge University Press. https://doi.org/10.1017/9781108235730.
Verissimo, D., Vieira, S., Monteiro, D., Hancock, J., & Nuno, A. (2020). Audience research as a cornerstone of demand management interventions for illegal wildlife products: Demarketing sea turtle meat and eggs. Conservation Science and Practice, e164.
Weber, E. U. (2017). Breaking cognitive barriers to a sustainable future. Nature Human Behaviour, 1, 0013.
Whitburn, J., Linklater, W., & Abrahamse, W. (2020). Meta-analysis of human connection to nature and proenvironmental behavior. Conservation Biology, 34(1), 180–193.
Wright, A. J., Verissimo, D., Pilfield, K., Parsons, E., Ventre, K., Cousins, J., ... McKinley, E. (2015). Competitive outreach in the 21st century: Why we need conservation marketing. Ocean & Coastal Management, 115, 41–48.
Zelenski, J. M., Dopko, R. L., & Capaldi, C. A. (2015). Cooperation is in our nature: Nature exposure may promote cooperative and environmentally sustainable behavior. Journal of Environmental Psychology, 42, 24–31.

**SUPPORTING INFORMATION**
Additional supporting information may be found online in the Supporting Information section at the end of this article.

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