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CONTRIBUTED PAPER

A framework for understanding the human experience of nature through cognitive mapping

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Abstract

Human behavior is a key driver of the biodiversity crisis, and addressing it requires changing individual choices and actions. Yet, the same processes that imperil biodiversity (e.g., urbanization) also alienate people from the experience of nature, eroding care for the natural world. Although averting this extinction of experience is increasingly recognized as a major contemporary conservation challenge, understanding of what constitutes nature experience remains elusive and few empirical studies have explored it directly. Most researchers have used nature interactions as a stand-in for experience, even though experience extends beyond interactions. We aimed to determine what constitutes the experience of nature and to propose a holistic, empirically derived framework that incorporates the multiple dimensions and components of the experience of nature. Using a mixed-method approach across 3 countries (the United States, Switzerland, and Israel), we conducted a multistage, conceptual content, cognitive mapping (3CM) exercise with 106 participants. This methodology included developing a prompt to capture participants' perceptions of nature experiences and subsequently refining and organizing their input into distinct components and underlying dimensions through an iterative engagement process. Beyond multisensory interactions with nature, experience of nature consisted of 2 dimensions: the circumstances in which interactions occur and the internal responses that encompass various cognitive, affective, and restorative benefits associated with nature interactions. These 3 dimensions had 33 components that occurred consistently across participants in the 3 countries. Frequently mentioned components included seeing animals, landscapes, or scenery; lack of human influence; weather conditions; relaxing, recharging; feeling good; and awe for nature. Fear and nature experienced at home were the least mentioned components. Together, our results showed that nature experience is a combination of nature interactions, circumstances, and internal responses. The emphasized components underscore the significance of offering access to extensive, less human-influenced natural spaces. This in turn can foster a profound nature experience, cultivating feelings of connectedness and care for nature.

KEYWORDS
3CM, conservation, cross-cultural, experience of nature, extinction of experience, human–nature interaction

INTRODUCTION

Biodiversity conservation is about changing people's behavior as much as it is about preserving species and ecosystems (Mascia et al., 2003). But the same processes that endanger biodiversity, such as urbanization, are increasingly isolating the majority of the world's population from nature experiences (Pett et al., 2016). This nature isolation is compounded by the urban lifestyle, which involves spending significant time indoors with limited exposure to nature and its complexity, leading to a growing alienation from nature (Lacoeuilhe et al., 2017). This alienation influences people's relationship with nature, conservation choices, and ability to benefit from interactions with nature (Bragg et al., 2013; Cox et al., 2018). Coined by Robert Pyle, the term *extinction of experience* illustrates this alienation from nature, emphasizing its significant contribution to the biodiversity crisis due to collective ignorance fostering collective indifference (Pyle, 1978, 1993). Nevertheless, there is no comprehensive understanding of what exactly nature experience is or what constitutes nature experience. This is because to date most researchers have used the terms *nature interaction* and *experience* interchangeably and few have attempted to directly characterize the experience of nature empirically (Gaston & Soga, 2020). Such knowledge is crucial for addressing the impacts of the extinction of experience.

Experience of nature involves more than mere interactions with nature or time spent in nature, which are much easier to measure (Gaston & Soga, 2020). Interactions involve sensory contacts with natural components, including visual, auditory, and olfactory stimuli (Clayton et al., 2017). Experience of nature is broader and can be described as "situations in which a person is engaged with an interaction on an emotional, physical, spiritual, or intellectual level" (Gaston & Soga, 2020). Experiences may include knowledge, skills, attitudes, and behavior and are heavily dependent on social and cultural contexts (Clayton et al., 2017; Gaston & Soga, 2020). Experience of nature most likely does include interactions, which are part of a process that includes precursors, such as learned associations with nature, and responses, such as emotions (Clayton et al., 2017), and these interactions can be augmented by a thought, a skill, or a reactional pursuit (Appleton, 1975; Kaplan & Kaplan, 1989). Although the experience of nature encompasses more than just nature interactions, it is often narrowly researched through proxies of interactions, such as time spent in nature or activities undertaken in nature, which only partially capture its essence.

Time or frequency of being in nature is often used as a proxy for nature interactions to assess the impact of nature experience on health, well-being, connectedness to nature, proenvironmental attitudes, and behaviors (e.g., Collado et al., 2015; Cox et al., 2017; Ferraro et al., 2020; Sato & Conner, 2013; Wells & Lekies, 2006). This important and vast literature demonstrates that spending time or activities in nature has diverse physical and mental health benefits, including faster recovery from illness and reduction in mental burden (Bratman et al., 2012; Jimenez et al., 2021; Tomasso & Chen, 2022). Examples of other well-being benefits from nature are personal satisfaction (Egerer et al., 2018) and feeling that one's life is worthwhile (Fretwell & Greig, 2019). The positive relationships between spending time in nature and well-being outcomes are consistent across genders, geographic locations, and age groups (Whitburn et al., 2020). Participation in nature-based activities is also linked to fostering proenvironmental behaviors, affinity, and connection to nature (Bixler et al., 2002; Collado et al., 2013; DeVille et al., 2021; Richardson et al., 2020), with childhood involvement in nature significantly influencing these outcomes (Chawla, 2020; Rosa et al., 2018). Only a few empirical studies have focused directly on the outcomes of sensory interactions with nature (Colléony et al., 2020; Fleming & Shwartz, 2023; Rickard & White, 2021). Findings from these studies indicate that merely being in nature may not be sufficient to maintain or strengthen nature connection and well-being and that the quality of nature interactions should be considered together with the quantity of interaction (Colléony et al., 2020; Richardson et al., 2021).

Additional qualitative studies on diverse nature activities, such as camping and desert or wilderness experiences, further contribute to understanding nature experience (e.g., Borrie & Roggenbuck, 2001; Garst et al., 2010; Patterson et al., 1998; Teff-Seker & Orenstein, 2019), although they also encompass only part of the full scope of the experience of nature. Different types of activities, such as wild nature experiences (hiking, camping, hunting) and domesticated nature experiences (flowers, planting, house plants), have also been identified (Wells & Lekies, 2006). Engagement with nature in conjunction with the benefits it provides is another avenue through which experience is examined. For instance, engagement with natural beauty is associated with well-being benefits, and a systematic review of children's engagement with nature showed different types of engagement, such as exploration and leisure (Capaldi et al., 2017; Gill, 2014). Other conceptualizations of the term *experience* include components such as focus, oneness, timelessness, solitude, and care, as demonstrated in Borrie and Roggenbuck's (2001) study of emotions and cognitions during outdoor recreation. Altogether, these studies reveal shared components that may fit within the broader construct of nature experiences, such as encountering nature's elements, experiencing wonder, escaping from daily routine, and being with others.

Research investigating nature connectedness or relatedness has also delved into the experience of nature, recognizing it as an integral aspect of the sense of connection to nature (Hatty et al., 2020; Nisbet et al., 2009; Tam, 2013). Hatty et al. (2020), for example, created an instrument to measure connection to nature that includes an experience dimension. This dimension, however, measures only enjoyment from undertaking outdoor activities rather than classifying more broadly what it means to experience nature. Nisbet et al. (2009) also include an experience dimension in their nature relatedness scale. This dimension, however, does not holistically measure experience, rather it measures one's familiarity and comfort with being in nature. Although research on connection to nature and proenvironmental attitudes demonstrates cross-cultural generalizability (Halffter, 2005; Schultz et al., 2005), previous studies related to nature experience have primarily focused on specific geographic locations. However, differences were recorded in research that explored the consequences of experience of

nature across different cultures (Amano et al., 2018; Tomasso et al., 2021). Studies exploring related themes, such as tourist perceptions in protected areas and desert recreational activities, have revealed differences among countries (Cochrane, 2006; Sagie et al., 2013). In essence, the indirect exploration of nature experience in specific contexts, along with the atomistic categorization of different activities and interactions, underscores the need for direct, thorough empirical investigations across diverse locations.

The *experience of nature*, although a prolific term in the literature, has rarely been studied directly and still lacks a comprehensive definition or framework in empirical research. Only a few studies have directly examined the experience of nature outside the realm of interactions. For example, Pollio and Heaps (2004) explored themes in the human experience of nature among undergraduate students. They identified 4 interdependent themes that define nature experience as power and scale, danger and safety, beauty, and connection and alienation. Building on dimensions of the concept of place, Pramova et al. (2022) theorized that a framework for the experience of nature includes sensory experiences, cognitive experiences, and affective experiences, all of which stem from settings and activities. Tomasso and Chen (2022) theorized that such a framework includes experiences that take place in a specific context, including one's social networks, community, and regulatory environments, where expectations, expectancies, and self-efficacy modify mechanisms (e.g., activities, stress reduction, etc.) through emotional responses that occur in nature. Testing these theories empirically can help provide deeper understanding into the experience of nature and its components. This step is important because current research often conflates experiences, interactions, their quantitative measures, and outcomes, underscoring the need to recognize these elements as separate yet interconnected within the broader context of nature experience.

We focused on the experience of nature and aimed to understand what constitutes the experience of nature across different countries. We sought to identify which components constitute nature experience and to understand how these components are related to each other to form dimensions of experience. We expected that the dimensions we uncover would align with, and provide empirical support to, the theorized frameworks (e.g., Pramova et al., 2022; Tomasso & Chen, 2022). Additionally, we aimed to explore how the dimensions of the experience of nature vary among countries. To address these aims, we used a conceptual content, cognitive map model (3CM) developed by cognitive psychologists to assess people's mental models and through them understand latent constructs (Kearney, 2015). This process asks respondents to identify mental objects or concepts related to a larger idea and show how those concepts are related to each other (Kearney & Kaplan, 1997). The 3CM has proven effective in exploring nature-based constructs, such as conservation planning (Biedenweg et al., 2020), soil management (Prager & Curfs, 2016), and fisheries policy (Wade & Biedenweg, 2019), and useful in identifying mental models related to conservation issues (Biedenweg et al., 2020). To the best of our knowledge, this study represents the first attempt to understand nature experience dimensions holistically and empirically across multiple countries. Such knowledge is pivotal for developing tools to monitor and enhance the quality of nature experiences, emphasizing the creation of meaningful moments in nature rather than mere minutes, and fostering a deeper connection to nature and overall well-being (Colléony et al., 2020; Richardson et al., 2021).

METHODS

We used 3CM (Kearney & Kaplan, 1997) to explore the components that constitute the experience of nature in 3 countries: Israel, Switzerland, and the United States. The model enables participants to communicate their understanding of the construct through a prompt and a card-sorting task. The multistage process was used to develop a framework for the experience of nature (Figure 1). The 3CM process is divided into 5 steps (Wade & Biedenweg, 2019): prompt design and pilot study (Step 1), item generation (Step 2), item reduction (Step 3), components grouping (Step 4), and dimension generation (Step 5). The process requires 2 separate sets of participants: one for item generation (Step 2) and one for component group (Step 4).

Participants

Two rounds of participant recruitment were conducted in the 3CM process: during Step 2, item generation, and during Step 4, components grouping. In Step 2, participants were recruited through various platforms, including social media, listservs (Facebook & WhatsApp), and word of mouth. In the recruitment messages, we asked participants to fill in a Google form with demographic information (age, gender, and country) and contact details. For Step 2, we performed 46 interviews in Israel ($n = 33$), Switzerland ($n = 8$), and the United States ($n = 5$). The Israeli interviews were conducted first; thus, we had the items generated by the Israeli participants when we started the interviews with the US and Swiss participants. It was clear after just a few interviews that no new items were being generated (i.e., data saturation was achieved and no new data were emerging) (Hassell et al., 2015). Because a qualitative analysis was conducted and data saturation was reached, the need for a similar number of participants from each country was less important. Few of the interviews were conducted face-to-face ($n = 5$). The majority occurred online ($n = 41$) due to constraints associated with the COVID-19 pandemic. Interviews in Step 2 typically lasted around 10 min, and, upon completion, participants received monetary compensation for their time (~ US$10 in the currency of their country in the form of a gift card).

In Step 4, we recruited a new set of participants with a similar recruitment process to the one used for the previous round of interviews. In the recruitment messages, we asked participants to fill in a Google form with demographic (age, gender, and country) and contact details. For this sample, we recruited a stratified sample based on age and gender to ensure

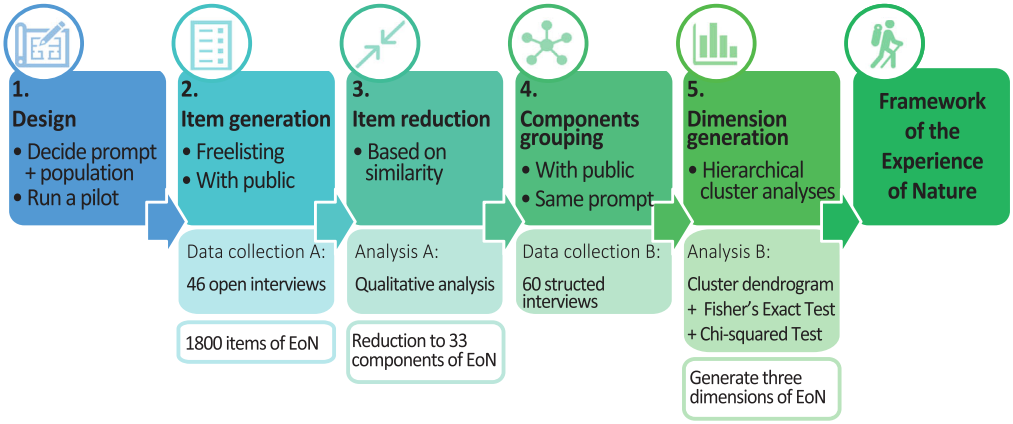

FIGURE 1 The 5 steps in the conceptual content cognitive mapping model of the experience of nature and an overview of the type of analysis and key outcomes of each step conducted in this study of people's experience of nature.

similar representation of gender and age in country. We interviewed 20 participants from each country (Israel, Switzerland, and the United States), 60 participants overall. For each country sample (n = 20), we recruited participants across 6 age categories (18–25, 26–35, 36–45, 46–55, 56–65, and over 65 years) and ensured there was at least one participant from each category and no more than 5 in any single category. For each country, we recruited no more than 11 participants per gender (all participants identified as either female or male). Interviews were conducted either face-to-face (26) or online (34) based on the participants' preferences. The interviews lasted about 20 min, and when they were completed, the participants received monetary compensation for their time (~US$15 paid in the currency of their country in the form of a gift card). Permission for this study was granted by the Technion Social and Behavioral Sciences Institutional Review Board (approval number 2022–048), and the research was performed in accordance with the board's relevant guidelines and regulations on human subjects.

Prompt design and pilot study (Step 1)

The first step in 3CM involves designing an opening prompt to activate relevant mental models in participants' minds (Kearney, 2015). The prompt should encourage participants to create a list of self-generated items, concepts, or thoughts. We employed an open-ended 3CM model, wherein participants generated items themselves, as opposed to a structured 3CM model, wherein items are selected from a list of possible items. This approach allows respondents the liberty to organically associate relevant concepts. This approach is particularly useful in exploring complex domains (Kearney, 2015), such as in-depth exploration of nature experience, eliciting memories of positive, negative, ordinary, and meaningful nature experiences.

The first prompt was developed through a discussion with an interdisciplinary research group (Appendix S1). Prompt pretest was suggested by previous researchers who had used 3CM (e.g., Kearney, 2015). We conducted 5 pretest Zoom interviews with participants from Israel and the United States because this part was conducted during the COVID-19 pandemic and lockdowns (Saarijärvi & Bratt, 2021). Based on the pretest feedback, the prompt was refined (Appendix S1) and then retested with 3 participants from the United States. The final prompt was: "Think for a moment about **the ways in which** you experience nature. As you know, experiencing nature involves many different things. Let's say that you are going to explain your thoughts about experiencing nature **and how you do so**, to a person who has never experienced nature. Please consider both positive and negative aspects of experiencing nature, as well as the quality of nature experience. What are the specific key items you will need to explain to them?" After the pretests were completed, we coded the answers with the Atlas.ti program and compared them with nature interactions and wilderness and desert experience in previous studies (e.g., Colléony et al., 2020; Patterson et al., 1998; Teff-Seker & Orenstein, 2019). The prompt appeared relevant because it yielded themes that had been mentioned in earlier studies and several new themes (Appendix S2).

Item generation (Step 2)

The aim of the second step is to harvest the items that respondents used to describe their perceptions of the experience of nature, which are then used to create item cards for subsequent steps. The item generation process involved short interviews in which participants wrote specific items or ideas in response to the prompt. This step is also known as free listing. Participants are allowed to view the item list and prompt throughout the interview. Previous studies that used open-ended 3CM models conducted 15–24 interviews (Biedenweg et al., 2020). To achieve a comprehensive understanding of the experience of nature, we performed 46 interviews until saturation of ideas was reached (Hassell et al., 2015).

In face-to-face interviews, each item that was mentioned by the participant was written down and placed in front of the participant. In online interviews, the interviewer typed the items

and shared them on the screen so that the list was visible to the participant. Due to the small number of face-to-face interviews, the theme distributions were compared between the 2 types of interviews and were found to be similar. During the interviews, participants were introduced to the research, asked to sign a consent form, and presented with the prompt. As items were mentioned, the interviewer wrote them down. The interviewer also offered reminders and repeated parts of the prompt to obtain comprehensive responses about the latent construct. Participants could freely add more items until they could not think of any more items (Kearney & Kaplan, 1997). This stage yielded a list of 1889 items, many of which recurred or represented very similar components.

Item reduction (Step 3)

The third step was used to condense the item list into a smaller number of components by identifying and thematically coding recurring and comparable items from the interviews, which showcased different aspects of the experience of nature. This reduction process, conducted independently by N.R. and W.F., sought to create approximately 30 components to avoid cognitive overload (Kearney & Kaplan, 1997; Wade & Biedenweg, 2019). During item reduction, each individual item was paired with comparable or analogous counterparts, leading to the generation of a list of components. Subsequently, each of these components was then assigned a descriptive title explaining the content encapsulated within. The separate analyses resulted in 2 lists of 32 and 34 reduced components, which exhibited significant similarity, reinforcing the reliability of the reduction process. After collaborative discussion, the 2 authors finalized a list of 33 components that described the experience of nature. To validate this step, we cross-checked related literature (e.g., Garst et al., 2010; Hassell et al., 2015; Richardson et al., 2020) to ensure essential constructs were not overlooked, and no additional items were added.

Components grouping (Step 4)

The fourth step provided insight into how the components relate to each other and helped to create connections between the components (Kearney & Kaplan, 1997). In the interview, the interviewer presented themselves, obtained participant consent, and presented the prompt developed in Step 1. Participants were then asked to select components from the list developed from Steps 2 and 3 that they deemed important and relevant to the prompt. All components were read out loud by the interviewer. Participants were encouraged to add any components they perceived as important but were missing from the provided list (this occurred very infrequently, and often components written by participants were already present, but looked over). This selection process is crucial to ensure that participants' final sorting reflects their genuine cognitive structure. Participants were further instructed to organize the chosen components into groups based on perceived relationships and label each group with a descriptive name or a short phrase. Participants were told they could make any number of groups and there was no limit or minimum to the number of components placed in their groups. In face-to-face interviews, components were written on cards, allowing participants to arrange them physically, with additional blank cards for adding new components if desired. In online interviews, the interviewer used whiteboard software that simulated the same activities (http://scrumblr.ca). The results from both types of interviews were similar. At the end of each interview, we took a picture of the final organization of the items and used it for the following dimension generation step.

Dimensions generation (Step 5)

The last step classified the components of the experience of nature into different dimensions, allowing for an understanding of the cognitive structure of the experience of nature. The pictures obtained from the last step of the study were used to input the grouping data into a table format. Each grouping received a row, and the selected components identified by participants were assigned a label of 1, whereas nonselected components were assigned a label of 0 for all groupings for all participants. We used this table for hierarchical cluster analyses (HCAs). An HCA is a useful tool for depicting how different components are related to each other (i.e., how frequently a component is combined with another component in an individual's card sort) and can be used to assess similar structuring of dimensions between interviewees (Wade & Biedenweg, 2019). The HCAs produced dendrograms that reflect measures of similarity. The components were projected on the vertical axis of the dendrogram, and the distance was projected on the horizontal axis. Each component started as its own cluster; the different components were then combined into larger clusters based on similarities in the way the components were grouped by participants. The resulting dendrogram reflected clusters of components based on similarities in how participants grouped them (King, 2022). Two components that had been selected <10 times were excluded from the analyses. All statistical analyses were conducted in R 4.0.5 (R Core Team, 2021). The optimal number of clusters (i.e., dimensions) was determined using the NbClust package, which compares 30 indices to identify the best number of clusters (Charrad et al., 2014). To explore differences in the perception of components across genders and countries, Fisher's exact and chi-square tests were used, respectively, and the analyses were conducted independently for each component. For components selected <5 times, a chi-square test was performed using bootstrapping.

RESULTS

The 3CM method identified 33 components that were later clustered into 3 dimensions (Table 1; Figure 2), which appeared to be the optimal number of clusters. The first dimension was interactions, which encompassed sensory connections to the natural environment, such as touch, smell, sight, and sounds,

TABLE 1 The 33 components of nature experience identified in a study of 106 participants from 3 countries and classification of the components into 3 dimensions.

Dimensions	Component	Explanation
Interactions	Biome/terrain	Different physical places one visits (e.g., forest, mountains, and desert)
	Landscape/scenery	Overall features and visible area of a place, including open areas and views one finds
	Natural components	Individual elements of nature, such as vegetation, water features, and rocks, an individual notices
	Lack of human influence, natural, wild	Overall sense that an area is untouched by people, including being uninhabited and uncultivated
	Animals, wildlife, birds	Animals one finds (e.g., dear, turtle, eagle, cow, birds, and butterflies)
	Insects	Disturbance of being bitten or otherwise negatively interacting with insects; also as exploration to look for bugs
	Colors, green	Coming into contact with a multitude of colors, especially green
	Fresh/clean air	Breathing in air that feels fresh
	Smells	Act of smelling nature, including scents from flowers, trees, sea, and smells carried on the wind
	Touching nature	Act of touching and perceiving nature through touching natural items
	Watching, viewing	Act (especially intentionally) of looking and watching; sight sense
	Sounds, listening	Act of hearing or listening to sounds in nature, such as birds, waves, running water, and wind
Encountered circumstances	Challenge	Ability to be challenged, including mental and physical effort, especially being uncomfortable but also having a sense of accomplishment
	Weather and physical conditions	Physical weather at a given moment, including wind, rain, hot, dry, and the climate that is changing all the time
	Being with others/children	Social aspect of the experience and who a person is with at the time such as friends, family, or children
	Crowded natural areas	Whether an individual finds a specific site crowded in a negative sense of being in nature with many people
	Danger, risks, lack of control	Coming across dangerous circumstances, including dangerous animals (snakes and ticks) and especially feeling a lack of control
	Destruction, pollution, garbage	Coming into contact with garbage or litter people leave behind, pollution, and construction
	Outdoor activities—passive	What one does in a passive sense including casual activities (e.g., sitting, strolling)
	Outdoor sports/recreation	Participating in a specific sport or activity (e.g., snorkeling, climbing, backpacking)
	Time spent, overnight	Amount of time one spends in nature or outside
	Equipment, prepared	Preparation for being in nature, to pack the gear, to know what to bring and when and where to go
	Human influence	Being faced with the good or bad influence and affects humans have in nature, especially interruptions or destruction that affects nature
Internal response	Novelty, curiosity, learning	Exploring and discovering nature, have new and exciting experiences, including a desire to know and encounter new things
	Being away/removed from everyday life	Feeling of breaking the daily routine, escaping from daily life and stress, including being away from noises such as from construction
	Good feelings, positive emotions	Feeling positive emotions, such as satisfaction, joy, fulfillment, happiness, and interest
	Regeneration/recharging, relaxing	Sensation of being restored, including regeneration, recharging, and relaxing
	Reflection, self-observation	Ability to reflect by connecting to oneself; consider and observe oneself
	Alone in nature/solitude, quiet	Feelings of remoteness and seclusion, including the opportunity to be alone, to have quiet and peace
	A part of it, sense of belonging, connection	Feelings of building the connection with nature, the feeling that one is a part of the world
	Amazing, awe, wonder	Reverential feelings from nature, including awe inspiring and overwhelming feelings and feeling of being speechless
Not clustered	Scared, fear	Feeling of being afraid or scarred in nature
	Nature in the home/TV podcast, books, pictures, social media	Indirect interactions with nature, watching nature documentaries, viewing nature on a phone or on television

Note: Appendix S3 contains the full list of items and their classification to components.

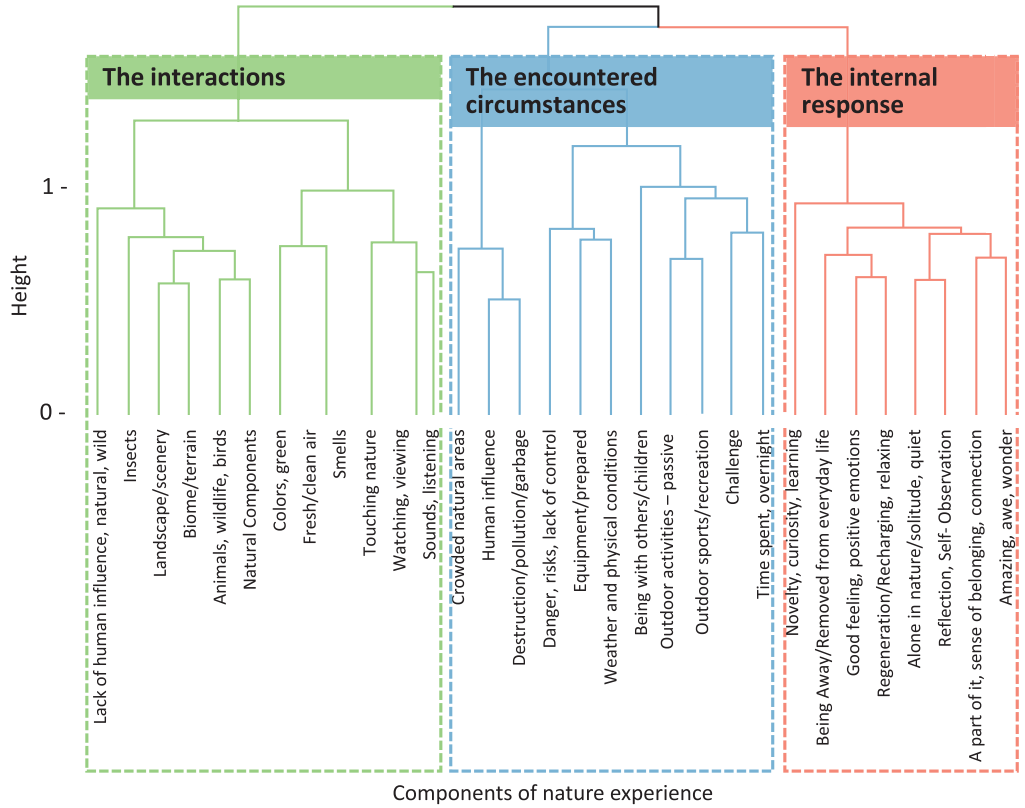

FIGURE 2 The cluster dendrogram describing the framework of the nature experience, which is characterized by the 3-dimensional structure composed of 31 components.

along with intrinsic components, such as landscapes type (e.g., desert, mountain, forest), scenic views, various colors of nature, greenery, vegetation, waterscapes, and wildlife. Second, encountered circumstances reflected the specific conditions and activities in a particular natural setting. It encompassed environmental conditions such as weather, temperature, and availability of food or energy, the duration of time spent in, and the presence of garbage at the site. The number of people sharing the same natural area (crowded nature areas), the companionship during the nature experience (e.g., children, family, or friends), and the potential challenges or risks encountered in nature were additional components. This dimension also covered a range of activities that can be undertaken in nature, including passive and active pursuits, such as sunbathing, sitting, walking, camping, climbing, and hiking. Third, internal response encompassed various cognitive, affective, and restorative benefits associated with nature experience. It included feelings of awe and detachment from everyday life, the novelty and thrill of exploring the unknown, and the curiosity that nature evokes. This dimension also included the silence associated with being alone in nature, the sense of belonging, and the feeling of connection to the natural environment, regeneration (i.e., the relaxing aspect of nature experience), and reflection (i.e., self-observation and introspection).

The most frequently listed components of the experience of nature were the natural components (trees, water, flowers, grass, rocks, sand, etc.) and the wildlife in nature (Figure 3). Similarly, the landscape and scenery of nature were frequently selected by participants, highlighting the significance of the overall view and the various elements that constitute nature. Several components were infrequently chosen. Aspects associated with negative experiences, such as scared, fear and danger, risks, and lack of control, were the second and third least selected components (Figure 3). The component reflecting indirect or indoor interactions with nature, such as watching nature documentaries, raising plants at home, and viewing nature landscapes on social media, was the least chosen among all participants (in only 2 of 60 interviews).

Among the 33 components, only 4 showed significant differences in distribution among countries. Three of these components ("biome/terrain," "sounds-listening," and "insects") were associated with the interaction dimension. Switzerland had higher selections for biome/terrain ($\chi^2 = 6.72$, $p = 0.035$) and insects ($\chi^2 = 6.72$, $p = 0.035$) compared with the United States and Israel. "Sounds-listening" was higher in Switzerland and the United States than in Israel ($\chi^2 = 9.45$, $p = 0.009$). The fourth component, "being with others or with children," representing the social aspect of nature experience, was less frequently chosen by participants from the United States compared with those from Israel and Switzerland ($\chi^2 = 6.93$, $p = 0.031$). Only one component, "a part of it, sense of belonging, connection," differed significantly between genders; females chose it more

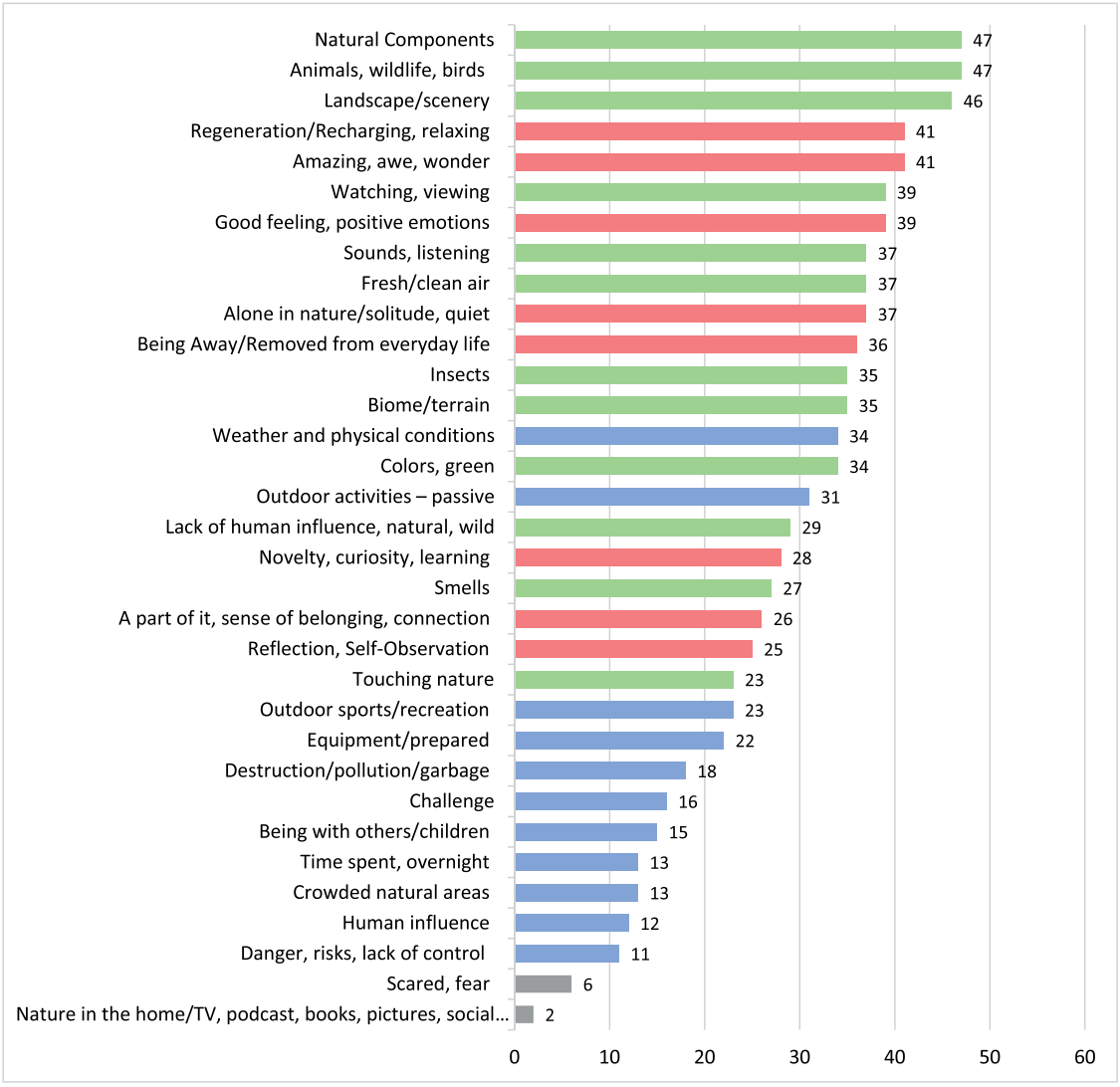

FIGURE 3 The number of times each of the 33 nature experience components were selected by 60 participants (Stage 3 of the conceptual content cognitive mapping process).

often than males ($p = 0.0212$). No other gender differences were recorded (detailed results in Appendix S4).

DISCUSSION

The decline in nature experiences and individuals' inability to experience nature are generally shown to negatively affect health, well-being, affinity for nature, and support for conservation efforts (Rosa et al., 2018; Soga & Gaston, 2016). Yet, to date, the study of nature experience has been fragmentary. Studies have focused mostly on a small subset of experience components, confounded nature interactions and time spent in nature with experience, or examined nature experience as a covariate of broader research agendas, including that of nature connectedness (Colléony et al., 2020; Gaston & Soga, 2020; Hatty et al., 2020). Through our novel use of 3CM, we unveiled 3 key dimensions of nature experience: nature interactions, circumstances, and internal responses. These dimensions were previously undefined and contribute to a more comprehensive understanding of the nature experience. These dimensions and the 33 related components correspond to themes proposed previously and encapsulate specific aspects of both dimensions and components (e.g., Pollio & Heaps, 2004; Pramova et al., 2022; Tomasso & Chen, 2022). This study is the first to concentrate empirically on the emergence of various dimensions of nature experience itself, rather than the outcomes such as personal nature connection or benefits derived from nature (e.g., Fleming & Shwartz, 2023; Hatty et al., 2020; Nisbet et al., 2009; Whitburn et al., 2020). It thus highlights the important role access to minimally affected natural environments can play in facilitating meaningful experiences of nature, which may in turn enhance feelings of connection and concern for the natural world (Chawla, 2020; Colléony et al., 2020).

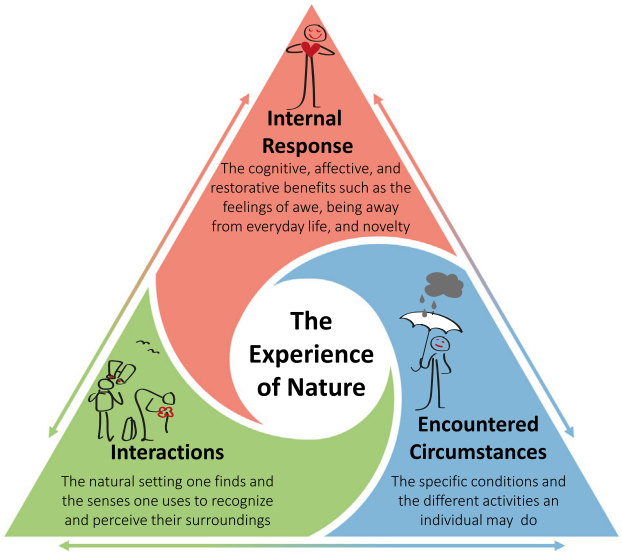

FIGURE 4 The 3 dimensions of the experience of nature: interactions, encountered circumstances, and internal responses. The dimensions interact to form the experience of nature.

Our results are consistent with results of previous research and expand on this work by providing a first holistic, empirical description of the interconnected components that together constitute the experience of nature. The 3 dimensions we identified can be thought of as what is there, what happens, and what is felt, and they can influence and support each other. Results of previous research that explored themes in nature experience are consistent with our findings. The data identifying the 3 dimensions contribute to a more detailed understanding of the intricacies of nature experiences. For example, Pollio and Heaps (2004) found themes around nature experience, such as power and scale, danger and safety, beauty, and connection and alienation. Our research extends this exploration by delving into the key components that constitute the broader nature experience. In our framework, the themes identified by Pollio and Heaps (2004) are represented in the components, which are encapsulated in the broad 3 dimensions (Figure 4). Our results also align with the proposed framework of Pramova et al. (2022); their elements (settings, activities, and sensory, cognitive, and affective experiences) are captured in our framework. Their framework suggests a causal direction from settings and activities to experiences, and our results indicate activities and setting are an integral part of the experience itself. This aligns more closely with the theoretical framework proposed by Tomasso et al. (2021), which posits that emotional responses are integral to the experience of nature, intertwined with mechanisms that drive subsequent outcomes.

Interactions dimension

The presence of interactions as a dimension of the experience comes as no surprise, given that interactions are a necessary prerequisite for experiences (Clayton et al., 2017; Gaston & Soga, 2020). This dimension includes both the natural objects and the senses engaged during the encounter. Previous studies focused on specific sensory experiences or aspects of nature, such as barefoot walking (i.e., touching; Rickard & White, 2021), smelling (Bentley et al., 2023), and listening (Whitehouse, 2015). Similarly, various studies have examined different components of nature, such as animals (Clayton et al., 2014; Lindemann-Matthies, 2005), landscape preference (Ren, 2019), and experiences in wild, untouched locations (Patterson et al., 1998). Based on these findings, and findings of many other studies, it is evident that the natural surroundings and the sensory experiences in those surroundings are interconnected.

The components related to the physical natural environment itself (i.e., biotic, abiotic, open scenery, and views) were the most chosen components, demonstrating their pivotal role in shaping the experience of nature. Animals and wildlife are considered attractive and help shape people's attitudes toward nature (Lindemann-Matthies, 2005). Seeing birds, in particular, improves nature connection, which in turn promotes proenvironmental behaviors that are compatible with nature conservation (White et al., 2023). For instance, Lindemann-Matthies (2005) showed that children develop a deeper appreciation for animals and plants when they learn about them firsthand. Facilitating opportunities for such interactions in green areas seems key to enhance the experience of nature. Preferences for open view and scenery align with stress reduction (Kaplan & Kaplan, 1989) and prospect refuge (Appleton, 1975) theories, drawing people to open vistas found in natural or seminatural settings with visible horizons. Scenic landscapes are more commonly encountered in large protected areas (i.e., nature reserves and national parks) or open seminatural areas, rather than in urban green space. This result highlights the importance of protecting these ecosystems not just for biodiversity conservation, but also as a means to connect people to nature and improve health and well-being.

Several components were rarely chosen, including "scared, fear" and "danger, risks, lack of control." Pollio and Heaps (2004) identified danger and safety as themes of nature experiences. Although these items were seldom selected, they might still influence the mental models of nature experience for individuals of other areas than the ones we studied. In the developed countries we studied, participants may have perceived natural environments as less threatening because, for example, potentially dangerous species have been eradicated from these areas (Patuano, 2020). Thus, in the context of this study, experiences of nature appear to be more associated with recreation or escape from urban life rather than danger (Puhakka, 2021), but this may be specific to the regions we studied. Further research is needed in other contexts and populations to shed light on the global relevance of these perceptions (Hosaka et al., 2017; Patuano, 2020). Although positive nature experiences may foster proenvironmental attitudes, they might also limit perceptions of nature by avoiding fear or feeling out of control. Understanding negative nature experiences and their implications for environmental attitudes and connection is important (Clayton et al., 2017).

Interactions with nature at home was the least chosen component, indicating that participants may not view such experiences as authentic nature encounters. Recent studies suggest that nature in media can enhance nature connectedness (e.g., Hedblom et al., 2022). Our research delineates a clear distinction between outdoor nature experiences and virtual and indoor nature encounters, highlighting a prevalent perception that genuine nature experiences are primarily associated with outdoor settings rather than indoor or mediated environments. However, we could not distinguish between indoor and virtual interactions with nature because they were frequently mentioned together in our item generation phase. This classification can potentially limit the comprehensive understanding of participants' mental models regarding indoor nature compared with virtual nature. Although people are increasingly encountering nature at home via technology, such interactions do not appear to be considered high-quality experiences of nature or at least not strongly linked to what individuals mentally associate with true nature experience. Although virtual experiences can provide benefits (e.g., connection to nature, well-being), the extent to which these benefits are equivalent to real nature experiences is still not clear and warrants further research (Spano et al., 2023). Our results emphasize the importance of genuine interactions with natural, especially outdoor, and seminatural open environments for enhancing nature experiences.

Encountered circumstances dimension

The encountered circumstance dimension encompasses the context and the settings of the nature experience. These circumstances point to the specificity of nature experiences. A nature experience is not generic and is characterized by particular combinations of noise, weather, the presence of others, and so on. Interestingly, the idea of solitude and absence of human influence were expressed much more often than the positive or negative presence of others. Yet, many people seek out nature experiences with others rather than on their own. This may suggest a discrepancy between what people believe to be a true experience of nature and what they choose in practice. A recent study on the well-being benefits of birdsong in nature shows audible birdsong and time talking with other visitors may negatively covary (Ferraro et al., 2020). This study may be showing the discrepancy whereby experience is diminished through the company of others. Solitude may also be closely linked to certain benefits provided by nature, and even a wilderness experience shared with others can still be perceived as a form of solitude.

Internal responses dimension

Numerous studies have demonstrated the mental benefits of nature experiences (Bratman et al., 2012; Elsadek et al., 2019; Jimenez et al., 2021; Takayama et al., 2014). In our study, the internal response dimension captures immediate feelings while experiencing nature. A large proportion of studies that deal with the mental benefits from nature experiences view these benefits as an outcome of being in nature (e.g., Bratman et al., 2015; Franco et al., 2017; Hartig et al., 2011). Internal emotional responses were seen as highly central to nature experience by the participants in our study. This could suggest that these emotional responses are not just outcomes of experience, but central to the experience itself. We suggest this dimension as an indicator of the subjective quality of experiencing nature and of the importance of an internal response. Previous studies also suggest that benefits from nature, including internal response, are related to the frequency and intensity of exposure to nature (Cox et al., 2017; Shanahan et al., 2015). The centrality of internal response to nature experience may suggest that the dose of nature in this sense is also related to the quality of the experience because it is related to that emotional response. To combat extinction of experience, measuring the extent to which a natural area elicits these benefits could help uncover the desirable design and planning strategies to maximize the quality and not just quantity of nature experience (Richardson et al., 2021; Shwartz, 2017).

Experience of nature across countries

Our findings indicated a consistent framework of the nature experience across gender, ages, and countries among our studied sample. This aligns with other cross-country studies on environmental concern and proenvironmental behavior that support cross-country generalizability of the relationship between humans and nature (Schultz et al., 2005; but see Colléony et al., 2019). Nevertheless, 4 out of the 33 components had significant selection differences among countries. One explanation for this selection bias may be differing values or nature connectedness of Swiss individuals (Colléony et al., 2019). However, because we did not measure these constructs, additional research on how values influence individuals' experiences with nature is warranted. The 3CM model proved valuable for uncovering nature experience dimensions in Western countries. Further research in less developed countries is needed to validate its applicability. Exploring cultural context can shed light on the universality of the positive nature experiences we found (Hosaka et al., 2017). A larger and more generalized sample would help validate our findings. Studying children and teenagers can provide important insights because enjoyment of nature experiences has been found to decrease with age (Clayton et al., 2019). Examining the contrast between children's and adults' nature experiences can carry significant implications for future conservation actions aiming to strengthen relations with nature, which are key to combating the biodiversity crisis (Richardson et al., 2019).

Our framework offers a broad understanding of the dimensions of nature experience and the diverse components that comprise those dimensions. This knowledge can have practical implications in guiding conservation efforts for enhancing the experience of nature and promoting its social and conservation outcome (Richardson et al., 2019), for example, designing viewpoints to allow visitors to experience the landscape or

providing hideouts for visitors near water sources that will allow visitors to observe birds. Multisensory designs can increase interactions and create closeness to nature, such as barefoot walking along a marked section or using an earpiece with recorded animal sounds along the trail (Bloch et al., 2023). Interventions that get people closer to nature can reduce psychological distance and increase nature interactions and positive feeling while spending time outdoors (Colléony et al., 2020; Shwartz, 2017). Our results highlight the value of outdoor nature interaction as a key construct of nature experience and demonstrate the centrality of affective components for experience. This underlines the subjective and emotional aspects of experience as central to the experience itself. Additionally, our findings underscore the significance of considering the circumstances surrounding these interactions, revealing that context plays a vital role in shaping and enhancing the overall quality of the nature experience. However, it is important to acknowledge that our findings are derived from a convenience sample of 106 participants from 3 countries. Although data saturation was achieved during our interviews, more research that uses cognitive mapping across diverse contexts, cultures, and groups (e.g., people with different levels of exposure to nature) is needed to broaden understanding the experience of nature.

Future researchers could also use this framework to develop a scale for assessing nature experiences and scale-up the results of this study using quantitative surveys. Development of a scale could in turn help validate the framework in holistically capturing nature experience. In a time of increasing disconnection from nature, understanding these components becomes crucial. Furthermore, our framework can be used as a basis for attempts to assess the quality of nature experience and to examine questions such as to what extent do components that were weakly represented in our study tend to have less of an effect or be less satisfying relative to the overall experience? Is it possible to increase the number of sensory interactions, to intensify the internal response, or to optimize the encountered circumstances in ways that will promote a more profound connection to the natural environment? Can an interaction with nature, such as a virtual interaction, have a positive impact even when it is not interpreted as a genuine experience of nature? Several of our results suggest that people's definitions of nature experience may not map perfectly onto actual practices, which may be more likely to be technologically mediated or shared with others. Further research could examine actual experiences of nature, including solitary and shared experiences, how they are perceived, and their impacts. Overall, this study contributes to the understanding of what it means to experience nature, and it has implications for nature conservation and natures' contribution to human well-being.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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