Cyclical Time Is Greener: The Impact of Temporal Perspective on Pro-Environmental Behavior

LAN XU
SHUANGSHUANG ZHAO
JUNE COTTE
NAN CUI

The natural environment is deteriorating. However, humans have not slowed down their pace of resource depletion and environmental destruction. This research takes a particular path to understanding environmental consumption—through a focus on temporal perspective. Evidence from six studies demonstrates the positive effect of a cyclical temporal perspective, versus a linear temporal perspective, on consumers' pro-environmental behavior. The research shows that individuals with a cyclical perspective are more likely to include the environment in the self, which leads to higher pro-environmental behavioral intentions and more pro-environmental behavior. This temporal perspective effect is attenuated for consumers already high on green values. The authors also examine a marketer-controlled moderator and show that consumers are more likely to purchase a pro-environmental product when they see a temporal-perspective-congruent promotional appeal. The research contributes to both the time perception and the environmental consumption literature and offers several practical implications for organizations to promote sustainable consumer behavior.

Keywords: temporal perspective, linear time, cyclical time, pro-environmental behavior, green values

Lan Xu (lanxu@whu.edu.cn) is a professor at the Research Center for Organizational Marketing and the School of Economics and Management, Wuhan University, Hubei, China. Shuangshuang Zhao (zhaosshello@gmail.com) is an associate professor at the College of Economics and Management, Northwest A&F University, Yangling, China. June Cotte (jcotte@ivey.ca) is the Kraft Professor of Marketing at the Ivey Business School, Western University, London, ON, Canada. Nan Cui (nancui@whu.edu.cn) is a professor at the Research Center for Organizational Marketing and the School of Economics and Management, Wuhan University, Hubei, China. Please address correspondence to Nan Cui. The authors thank Jingting He for her early work on data collection and analysis. This work was funded by research grants from the National Natural Science Foundation of China (NSFC 71772141, 71872140, 72072135, and 71472142). Supplementary materials are included in the web appendix accompanying the online version of this article.

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Our earth has suffered the loss of 90% of the planet's biodiversity and is experiencing continuous global warming and growing waste pollution (UNEP 2022). Environmental degradation threatens both human and planetary health. Given the dire situation, how can organizations influence consumers to consider the environment and change their attitudes and behaviors? That is a multifaceted question, of course, and our research takes a particular path to some answers. Our research investigates the question through the lens of temporal perspective, which we argue is a crucial factor influencing consumers' relationships with the natural world.

People's perception of time is important to how they view the world. It includes one's temporal orientation toward the past, present, and future, as well as temporal perspective, an overall perception of how time goes by (Cotte, Ratneshwar, and Mick 2004; Graham 1981). Temporal perspective has generally been classified into

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two types (Ancona, Okhuysen, and Perlow 2001; Saunders, Van Slyke, and Vogel 2004). People with a *linear* perspective regard time as a straight line—there is a past, present, and future (Ancona et al. 2001). Linear time stretches unidirectionally from an irrevocable past to an unknown remote future; it does not repeat (Overton 1994). On the contrary, people with a *cyclical* perspective perceive time as a circular system in which the same events are repeated in solar, lunar, or seasonal patterns (Saunders et al. 2004). The past can be expected to repeat itself in the future (Hurmerinta-PeltomÄki 2003). Temporal perspective has a trait-like nature; however, a particular temporal perspective can also be cued or primed by a marketer (Tam and Dholakia 2014).

Research on the relationship between people and time usually discusses the relationships between people and space simultaneously (Chae and Hoegg 2013). We focus on one specific aspect of space: the natural environment. Building on the work on time/space perceptions from many domains, we investigate consumers' behavior and attitudes toward the natural environment. Our research asks two main questions: (1) How is temporal perspective related to consumers' treatment of the natural environment? (2) Knowing the answer to question 1, what can organizations do to influence pro-environmental consumption?

We examine these questions in six experimental studies, including field and controlled experiments with consumers from China, North America, and Europe. Our research roadmap is shown in figure 1. We argue that consumers with a cyclical temporal perspective are more likely to demonstrate environmental behavior than those with a linear temporal perspective. This effect occurs because consumers with a cyclical (vs. linear) temporal perspective are more (vs. less) likely to include the environment in their sense of self. We also examine a boundary condition such that the temporal perspective effect only manifests among people who are not already very high on green values. Moreover, from a managerial perspective, we examine an actionable way to influence pro-environmental consumption—congruence between promotional appeal and temporal perspective leads consumers to behave more pro-environmentally.

Our work identifies temporal perspective as a novel way to address an increasingly important global *phenomenon*, namely sustainable consumer behavior. We make *theoretical* contributions to the research on temporal effects on thoughts and behaviors. We also demonstrate both an individual factor and a marketing lever by which organizations can encourage pro-environmental behavior.

THEORETICAL DEVELOPMENT

People's temporal perspective influences their behaviors (Cotte et al. 2004; Graham 1981; Tam and Dholakia 2014). For example, people who view time from a cyclical perspective save more money (Tam and Dholakia 2014) and prefer a larger but later available option in an intertemporal choice task (Xu et al. 2019). In the organizational context, people who see time as cyclical are less likely to manage their tasks timely but more likely to develop creative ideas (Saunders et al. 2004). Firms can use a cyclical temporal perspective to exploit their firm's prior experience (Hurmerinta-PeltomÄki 2003) or emphasize their product's stability (Mosakowski and Earley 2000). Although various studies have explored the influence of temporal perspective, research on how and why temporal perspective affects *consumption* behavior is still limited. Focusing on the sustainable consumption field, we develop our theorized connections between temporal perspective and consumers' pro-environmental behavior in the following section.

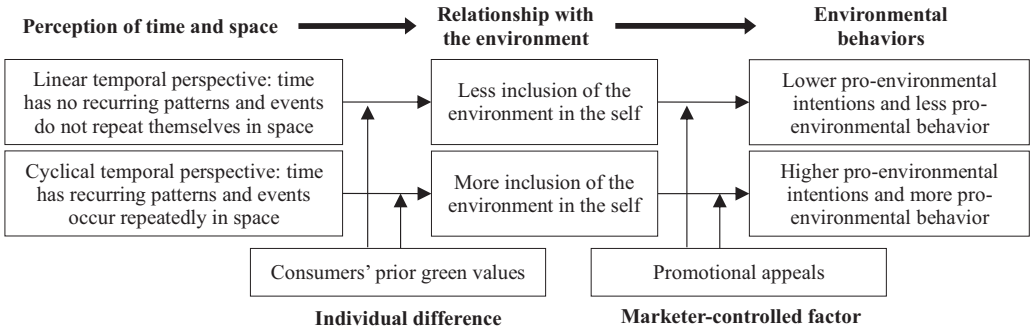
The Connection between Time/Temporal Perspective and Space/Natural Environment

Time is often described using a distance metaphor. Humans use spatial terms to describe aspects of time, such as time moving forward (Boroditsky 2000; Lakoff and Johnson 1980). Research has shown that a conceptual mapping exists between spatial distance and time duration (Kim, Zauberman, and Bettman 2012). Empirical evidence also supports that spatial relation information affects how people think about time (Boroditsky 2000). In terms of human experience, time is not perceived in isolation, but is related to space and even to actions and events that happen within space (Mosakowski and Earley 2000). In the consumption realm, examining time–space synesthesia, or the phenomenon that consumers' sense relating to time could be linked to their sense relating to space, Chae and Hoegg (2013) found an effect of past-left, future-right representation of time and space on how consumers process advertising. Time-space entanglements are also evidenced in other consumption-related activities, such as consumers' tattoo behavior (Roux and Belk 2019).

Time can even be viewed as the fourth dimension to measure how people act in spaces (Friedman 1990). People build autobiographical memory by recollecting personal experiences that occurred in specific times and spaces (Baumgartner, Sujan, and Bettman 1992). When perceiving how time moves, people inevitably retrieve experiences about how they acted in both space and time. Cyclical time and linear time, the two types of temporal perspective we investigate, are actually ideas borrowed from people's observation of the linear or circular nature of spatial movement (Overton 1994). In this sense, temporal perspective is a perceptual schema that relates an actor's experiences with time to his/her experiences with space. According to schema theory (Fiske and Taylor 1991), not only are schemas formed by past experiences but they also shape or

FIGURE 1

RESEARCH ROADMAP



reconstitute our experiences: people actively organize what they experience by using a familiar set of schemas rather than by rote memorization of details. When a temporal perspective is activated in one's mind, it serves as a schema that allows people to reorganize their experiences with space so that their experiences can be congruent with the temporal perspective activated (Schwarz 2004). Priming a temporal perspective (about how we feel time moves) would thus simultaneously evoke our experiences, which are harmonized with this time pattern, about how we interact with the environment around us. Next, we elaborate on how temporal perspective influences environmental attitudes and behavior.

Cyclical Time and the Environment. A cyclical temporal perspective is associated with the perception that actions are recurrent and regular over time (Jones and Coviello 2005). People with a cyclical temporal perspective believe that time is a circular system in which the same actions or events are repeated with regular patterns (Ancona et al. 2001). This perspective leads to the perception of iterated, accumulative interactions with the environment (Mosakowski and Earley 2000; Saunders et al. 2004).

Echoing the idea that people following the repetitive pattern of time accumulate repeated experiences with the environment, research argues that those deeply embedded in a cyclical temporal pattern enact a long-present mindset—the present, past, and future are connected so that the present is perceived over an extended duration (Kim, Bansal, and Haugh 2019). This long-present mindset leads to enhanced connections with the current environment, allowing producers to make immediate and incremental improvements (Kim et al. 2019).

In addition, the cyclical temporal perspective is linked with polychronic daily experiences, juggling multiple activities synchronically (Saunders et al. 2004). When time goes in a circle and cannot be divided into separable parts, things are perceived to be interconnected as a system within a bounded space (Graham 1981). People who perceive time cyclically thus readily integrate work into their family spaces (Kaufman-Scarborough 2006). As activities are performed as an interconnected system, people focus more on how to work with the whole system than on specific tasks (Bluedorn, Kaufman, and Lane 1992).

Therefore, when encountering a consumption decision relating to the natural environment, the personal experience of connection to the environment, evoked by temporal perspective, will influence consumers' pro-environmental intentions and behavior. With a cyclical perspective, people have repeated, accumulated, and enhanced experiences with the environment and feel that human activities and natural resources are interconnected to form a system (Kim et al. 2019). This leads to connections with the environment, a sense of place, which facilitates pro-environmental behavior (Beery and Wolf-Watz 2014).

Linear Time and the Environment. With a linear temporal perspective, time goes forward from the past into the future and never goes back to the past (Ancona et al. 2001). Time is viewed as separable and progressive (Robinson, Veresiu, and Babić Rosario 2022). The past is the past, and the future represents a new set of situations separated from the past; people expect movement from the present to the future (Graham 1981; Kim et al. 2019).

People who see time linearly expect that the environment varies (passes) just as time passes. This idea of environmental variation can be illustrated through the famous statement of the Greek philosopher Heraclitus that a man cannot step twice into the same river (Strain 2014). In this sense, people are less likely to expect to have repeated experiences with the environment. It is reasonable to juxtapose one's environment at present against the future because humans' relationships with the environment also change over time (Kim et al. 2019). People who see time as linear are thus more likely to be comfortable extracting resources from the earth and be free from dependence on

the natural environment (Washington 2012). As time is expected to march forward to a desirable future (Tam and Dholakia 2014), people may also expect to move to a new place that is different from the past: it may be a new type of natural environment (e.g., using genetic technologies to transform nature), or a new artificial environment (e.g., metaverse), or a new physical environment (e.g., settlement in a new city).

Moreover, people with a linear perspective seem to do only one thing at a time (Saunders et al. 2004). They need to sacrifice one thing for another to complete an activity within a time duration (Bluedorn et al. 1992) and tend to consider the tradeoff between benefits for different activities, ignoring the systematic relationship between activities (Hecht and Allen 2005). Following this "one thing at a time" thinking, people who think of time as linear are more likely to think of humans as being separated from the environment and are less concerned that human activities influence the environment (Lauderdale 2008). Thus, the separable-progressive nature of a linear perspective reduces people's connections to the current environment and decreases their pro-environmental intentions and behavior. Considering the relation between cyclical versus linear temporal perspectives and people's environmental attitudes and behavior, we argue:

> **H1:** Temporal perspective influences consumers' pro-environmental intentions and behavior such that a cyclical (vs. linear) temporal perspective leads to greater pro-environmental intentions and behavior.

The Self and the Environment

Although there are multiple causes of pro-environmental behavior, we argue that temporal perspective changes how much one feels personally connected to the environment. We use the inclusion of the environment in the self (IES), the extent to which one includes the environment in one's sense of self, to describe the connection between people and the environment (Schultz 2001). Next, we outline how and why temporal perspective affects IES, which in turn predicts environmental behavior.

Temporal Perspective and IES. The idea of an extended self implies that people expand the self to include outside elements (other people, things, experiences) into their sense of self (Belk 1988). Research in environmental psychology argues that individuals with a strong feeling of connectedness to the natural environment include the natural environment in their self-concept (Schultz and Tabanico 2007). A body of convergent evidence has shown that the inclusion of nature in the self is built on one's experiences with the natural environment (Schultz 2001). For example, research shows that the time spent outdoors was positively associated with the inclusion of the natural environment in the self (Baxter and Pelletier 2019).

Due to its experiential nature, the inclusion of the environment in the self is contextual and malleable; it can be changed by manipulating the experience with nature or activating the episodic memory of the experience with nature (Soliman, Peetz, and Davydenko 2017). For example, participants sitting in a room with a window providing a view of the outdoors and plants (vs. with windows closed, no plants) were found to have a higher level of inclusion of nature in the self (Scott 2010). Likewise, participants imagining a journey through nature showed increased inclusion of nature in the self (Mackay and Schmitt 2019). Viewing photographs of slides or videos of the natural environment increases individuals' feeling of connectedness with the natural world and incorporating nature into the self (Soliman et al. 2017).

We argue that temporal perspective can also affect IES because it serves as a perceptual schema that connects people's perception of time to their feeling of connection with the environment. As we discussed, people with a cyclical temporal perspective are inclined to associate a repetitive time pattern with their repeated interactions with space (and the environment) where they live (Ancona et al. 2001). Indeed, repeated experiences in the same environment lead to a cognitive and emotional attachment to the environment (Baxter and Pelletier 2019). As such, the expected repeated and predictable experiences evoked by a cyclical temporal perspective provide people with a sense of environmental connectedness, increasing the incorporation of the environment into their selves (Golden and Mayseless 2008).

Moreover, people with a cyclical perspective tend to be immersed in a long-present state (see the future as an extended present), enabling them to attend to the current environment and be attuned to how the environment and themselves affect each other (Amel, Manning, and Scott 2009; Kim et al. 2019). This long-present state nourishes long-term interdependence between man and the natural environment, producing a heightened sense of connection to the natural environment, which facilitates the inclusion of the environment in the self (Clayton and Opotow 2003). In addition, the polychronic daily experiences commonly associated with a cyclical temporal perspective engender the feeling of interconnectedness of things and increase person-environment fit (Hecht and Allen 2005), which promotes IES.

In contrast, people with a linear perspective view time as separable, progressive, and non-repetitive (Mosakowski and Earley 2000). Consequently, people are motivated to explore new and desirable environments rather than investing in the incremental improvement of the currently undesirable environment (Kim et al. 2019; Robinson et al. 2022). Therefore, they are less likely to believe that humans and the environment are interconnected and less likely to develop a strong emotional attachment to the

environment (Beery and Wolf-Watz 2014), decreasing the likelihood that people include the environment in the self.

IES and Pro-Environmental Behavior. There is considerable evidence that the inclusion of the environment (or nature) in the self predicts pro-environmental behavior (Mackay and Schmitt 2019; Schultz 2001; Schultz et al. 2005; Steg et al. 2014). Incorporating the environment into one's self leads people to view threats to the environment as threats to themselves, increasing their efforts to reduce those threats via pro-environmental behavior (Clayton and Opotow 2003). Moreover, people with high IES are more likely to view nature as intrinsically valuable rather than the resources or benefits it might offer (Schultz 2001), facilitating voluntary pro-environmental behavior (Peck et al. 2021). Conversely, people with a linear temporal perspective feel less connected to the natural environment and see the self and the environment as separate entities (Beery and Wolf-Watz 2014). They are thus less likely to behave and consume pro-environmentally (Mackay and Schmitt 2019). Hence:

> **H2:** The inclusion of the environment in the self (IES) mediates the relationship between temporal perspective and pro-environmental intentions and behavior.

A Boundary Condition: Consumers' Prior Green Values

Values are inherently cognitive, reflecting beliefs people consider vital and desirable in their lives (Schwartz 1992). Personal values are shaped by deliberative processes and are reinforced with re-evaluative efforts (Kenter, Reed, and Fazey 2016). They tend to be stable over time (Schwartz 1992), affect how people see themselves (Rokeach 1973; van der Werff, Steg, and Keizer 2013), and have an overall effect on people's attitudes and behaviors (Hitlin and Piliavin 2004). Evidence has shown that people's green values, the idiosyncratic personal values they place on environmental protection, drive pro-environmental behavior (Haws, Winterich, and Naylor 2014; Verplanken and Holland 2002).

We predict that temporal perspective will only affect pro-environmental behavior for consumers who are not already high on green values. When green values are core personal values, consumers consider environmental protection important in their lives and likely already include the environment in their sense of self (Verplanken and Holland 2002). Therefore, the positive influence of the cyclical (vs. linear) temporal perspective on IES would be attenuated. Consequently, we would not observe a significant difference in pro-environmental behavior between consumers with a cyclical and a linear temporal perspective. In contrast, consumers who do not consider protecting the environment as a core personal value are more likely to be affected by a cyclical perspective because thinking of time cyclically generates one's personal experience with the environment based on an associative process. The experience evokes a sense of environmental connectedness, facilitating the incorporation of the environment in one's self (Kim et al. 2019; Mosakowski and Earley 2000). Thus:

> **H3:** Consumers' prior green values moderate the link between temporal perspective and inclusion of the environment in the self (IES), such that the link only manifests for consumers with low (vs. high) level of green values.

A Marketer-Controlled Moderator: Promotional Appeal

We examine a possible marketer-controlled moderator of the relationship between temporal perspective and pro-environmental behavior: the type of promotional appeal for pro-environmental products. Specifically, we investigate two types of promotional appeals: a self-interested appeal and a biosphere-interested appeal (Steinhorst, Klöckner, and Matthies 2015). A self-interested appeal emphasizes the benefits that environmental improvement could provide for *humans themselves*. In contrast, marketers could promote the same product or service using a biosphere-interested appeal, emphasizing the benefits provided for the *environment*. Based on the self-congruency effect (Chang 2002), we argue that the relationship between temporal perspective and pro-environmental behavior will be stronger when consumers encounter a promotional appeal that is congruent with consumers' temporal perspective.

Self-congruency theory posits that a person is motivated to engage in behaviors when presented with a message that is congruent with the person's self-concept (Sirgy 1982). As we discussed, temporal perspective is related to individuals' environmental self-concept such that a cyclical perspective will trigger the inclusion of the environment in the self-concept, which is congruent with promotions using a biosphere-interested appeal emphasizing the product's benefits for the whole environment. In contrast, a linear perspective primes one to view the environment and the self as separate and thus tends to be more anthropocentric (Graham 1981; Mosakowski and Earley 2000). Hence, this temporal perspective is congruent with promotion using a self-interested appeal that highlights the product's benefits for the self. Therefore, we expect that pro-environmental behavior would be enhanced (weakened) if a promotional appeal (self-interested vs. biosphere-interested) is congruent (incongruent) with consumers' temporal perspective. Specifically,

> **H4:** The type of promotional appeal moderates the effect of temporal perspective on pro-environmental behavior. Specifically, pro-environmental behavior will be enhanced when promotional appeals are congruent with consumers'

temporal perspective (i.e., a biosphere-interested appeal with a cyclical temporal perspective and a self-interested appeal with a linear temporal perspective).

We conducted six studies, using both actual behavior and intentions as dependent variables, to test our hypotheses. Table 1 presents an overview of the studies. Study 1 uses actual behavior to test the main effect of temporal perspective on pro-environmental behavior (hypothesis 1). Study 2 replicates the main effect (hypothesis 1) in a natural setting to enhance the external validity of our findings. Study 3 examines the mediating role of IES (hypothesis 2) in an incentive-compatible choice experiment. Study 4a is a two-phase study wherein we examine whether prior green values moderate the relationship between temporal perspective and environmental behavior (hypothesis 3). Study 4b replicates the moderating effect of prior green values, using different construct operationalizations and in a different culture (hypothesis 3). Study 5 examines whether the congruency between products' promotional appeal and consumers' temporal perspective affects pro-environmental behavior (hypothesis 4).

STUDY 1: EFFECT OF TEMPORAL PERSPECTIVE ON SUPPORTING A PRO-ENVIRONMENTAL POLICY

Study 1 aimed to test the main effect of temporal perspective on pro-environmental behavior. We predicted that priming a cyclical perspective (vs. a linear perspective) would cause participants to be more willing to contribute their time to support a pro-environmental policy.

Method

One hundred and twenty undergraduate students (46.7% male, $M_{age} = 22.72$, SD = 4.19) took part in this between-subjects experiment at a Chinese university. They were randomly assigned to two conditions (linear vs. cyclical temporal perspective).

Participants completed two ostensibly independent tasks. In the first task, they were asked to read a brief description of how time passes in daily life. The description of linear time outlined that life consists of separate and progressive time periods, with time moving forward. In contrast, cyclical time described life as consisting of many cycles, with time repeating (see table 2 for the manipulation details of all the studies). Participants were then asked to write a paragraph about how time passed in their daily life. As a manipulation check for temporal perspective, participants rated how they felt time passing on a 9-point semantic differential scale (1 = time keeps moving forward; 9 = time is repetitive and cyclical).

In the second task, participants received a proposal from a student society that advocated introducing a waste collection policy in their university (web appendix B). They were asked to volunteer for no more than 10 minutes online to propose ideas or suggestions for supporting the policy. Those unwilling to do so could freely skip this task and continue the remaining parts of the experiment. The volunteers needed to click a link to another web page and provide their ideas (e.g., how to encourage others to participate) within 10 minutes. Also, they could quit the task at any time they would like. The click-through rate (the ratio of participants who clicked on the link to the total number of participants) was calculated as the dependent variable. Finally, participants' general demographic information was recorded.

TABLE 1

OUTLINE OF STUDIES

Study	Tests	IV Manipulation	DV Operationalization	Mediators or moderators	Sample
1	Hypothesis 1	Verbal manipulation	Actual click-through behavior	None	Chinese undergraduate students
2	Hypothesis 1	Verbal manipulation with posters	Actual packaging material drop-off behavior (drop-off percent and drop-off customer percent)	None	Chinese university community
3	Hypothesis 1, hypothesis 2	Verbal manipulation	Actual product choice for a lucky draw prize	IES	Chinese undergraduate students
4a	Hypothesis 1, hypothesis 2, hypothesis 3	Workout scheduling	Index of intended pro-environmental behaviors	Prior green values (green consumption scale); IES	North American adults—MTurk online platform
4b	Hypothesis 1, hypothesis 2, hypothesis 3	Verbal manipulation	Index of purchase preferences for eco-friendly products	Prior green values (biosphere values scale); IES	European adults—Prolific Academic online platform
5	Hypothesis 1, hypothesis 4	Verbal manipulation	Purchase intentions of the advertised product	Promotional appeals (self-interested vs. biosphere interested)	Chinese adults—Tencent online platform

TABLE 2

TEMPORAL PERSPECTIVE MANIPULATIONS ACROSS ALL STUDIES

Study #	Linear time condition	Cyclical time condition	Control condition
1, 5	Our lives consist of separate and progressive time periods, just like childhood, adolescence, and adulthood. Events are over once they were in the past. We will never go back to the past life.	Our lives consist of many small and large cycles, that is, events that repeat themselves, just like day and night alternate ever, like the four seasons come and go every year. We always stay in a cyclical process.	None
2	Time flies like an arrow. Time moves forward. Life is progressive and never goes back to the past. Time flows while the country is so beautiful.	Spring goes, spring comes. Time moves in a recurring pattern. Life repeats like days and nights alternating, and the four seasons come and go. Time goes in a circle while the country is so beautiful.	No temporal perspective cues
3	Our lives consist of separate and progressive time periods, just like childhood, adolescence, and adulthood. Events will never repeat themselves once they are in the past. We move forward to the future and never go back to the past life. We usually stay in a linear process.	Our lives consist of many small and large cycles, that is, time that repeats itself, just like day and night alternate ever, like the four seasons come and go every year. Events often recur periodically. When things are completed in the current circle, we will do them over again in the next circle. We usually stay in a cyclical process.	Participants were asked to recall what they did last week and write about how they feel time passes in their daily life.
4a	The current workout schedule is regarded as one part of a linear approach. In this schedule, we will make our workout tasks progressive and complete our workout tasks before going to the next workout stage. Note that the future will be a road that stretches forward and onward from the present and never repeat the present. Keeping moving forward without repeating itself, we will make exercise a lifestyle that sticks.	The current workout schedule is regarded as one part of a cyclical approach. In this schedule, we will make our workout tasks routinized and keep repeating our workout tasks cycle by cycle. Note that the future will be exactly like the present as these cycles repeat themselves. Keeping repeating workouts in cycles, we will make exercise a lifestyle that sticks.	None
4b	Same as study 3	Same as study 3	None

Results

The temporal perspective manipulation was successful ($F(1, 118) = 155.36$, $p < .001$, $\eta_p^2 = 0.568$). Participants in the cyclical perspective condition were more likely to perceive time as repetitive ($M_{cyclical} = 6.37$, SD = 2.34) than those in the linear perspective condition ($M_{linear} = 1.83$, SD = 1.58).

Compared with those with a linear perspective ($M_{linear} = 13.30\%$), participants with a cyclical perspective ($M_{cyclical} = 31.70\%$; $\chi^2 = 5.78$, $p = .016$, $\Phi = 0.22$) had a higher rate of clicking on the volunteering, consistent with hypothesis 1.

Discussion

The findings provide evidence that temporal perspective impacts pro-environmental behavior. Compared with those with a linear perspective, people with a cyclical perspective are more likely to support pro-environmental projects. In a supplemental study (web appendix N), we also found that a cyclical perspective led to higher pro-environmental intentions than a linear perspective when controlling individual differences in temporal orientation.

STUDY 2: EFFECT OF TEMPORAL PERSPECTIVE ON PACKAGE RECYCLING

Study 2 examined whether firms can increase consumers' pro-environmental behavior using temporal perspective cues in a natural setting. We conducted a field experiment at two CAINIAO pick-up stores on a large Chinese university campus. CAINIAO is the largest logistics service platform company in China, with more than 200,000 pick-up stores providing delivery services for online consumers. The company runs the Cardboard Box Return Project, a campaign to decrease the environmental threat from the heavy use of cardboard boxes and plastic bags in logistics. The project encourages consumers to unwrap their packages immediately upon picking them up and deposit packaging materials in a collection box at the pick-up store (widespread home recycling programs are not common). We placed posters around the collection boxes to induce a (linear vs. circular) temporal perspective perception and examined how temporal perspective cues influenced pro-environmental behavior.

Method

We conducted the experiment at two CAINIAO pick-up stores on Tuesdays, Wednesdays, and Thursdays for three consecutive weeks. The two stores are located on the same university campus, about 500 m apart. We collected data from 11 am (1 hour before the stores' peak hour) to 7 pm (the stores' closing time) each day. Store management suggested using these three weekdays because package pick-up frequencies were more stable on these days than the other 4 days of the week.

Two poster versions, pretested (see details in web appendix D), were created to manipulate temporal perspective, one displaying the cyclical cues and the other displaying the linear perspective cues. The heading of the cyclical posters reads, "Spring goes, Spring comes," and the body has messages such as "Time moves in a recurring pattern" and "Life repeats itself like days and nights alternating." The heading of the linear posters reads, "Time flies like an arrow," and the body has information such as "Time moves forward" and "Life is progressive and never goes back to the past." Other information on all the posters is the same, briefly describing the CAINIAO pro-environmental campaign (see details in web appendix E).

We did not place any posters at the stores in the first week but recorded package pick-up behavior and packaging material drop-off behavior as baseline control measures. This week's observations help to check whether the drop-off behavior was significantly different between the two stores. In the second week, we placed two cyclical posters (one floor poster and one wall poster) at one of the pick-up stores and two linear posters (also one floor poster and one wall poster) at the other pick-up store. A collection box was placed near each store's exit. The floor poster stood facing the doorway. The wall poster was placed above the collection box (see web appendix E for more details). The posters were left in place from 11 am to 7 pm and were taken away after 7 pm each day. In the third week, we swapped the posters at the two stores and continued the experiment. Hence, we could assess whether store characteristics confounded the temporal perspective effect.

To account for the customer traffic of each store, we used two relative measures of drop-off behavior: *drop-off percent* (the number of cardboard boxes or plastic bag drop-offs for each hundred package pick-ups) and *drop-off customer percent* (the number of people who unwrap and drop off a packaging box or bag for each hundred pick-up customers). The number of box and bag drop-offs was counted by two research assistants at each store after 7 pm per day. The number of package pick-ups was obtained from each store's manager. The research assistant at each store secretly observed customer behaviors. They counted the number of pick-up customers and the number of customers who left their packaging behind using manual clickers. We also included two weekday dummies (Tuesdays as baseline) in the subsequent statistical analyses to control the time-fixed effects of different weekdays.

Results

We used the data collected in the first week to examine whether there were significant differences between the two pick-up stores without the temporal perspective manipulations. A series of analyses of covariance (ANCOVA) with stores as the factor and the two weekday dummies as the covariates revealed that there was no significant main effect of stores on drop-off percent ($M_{store1} = 1.90$, SD = 0.30, $M_{store2} = 1.59$, SD = 0.25; $F(1, 2) = 1.17$, $p = .393$, $\eta_p^2 = 0.369$) or drop-off customer percent ($M_{store1} = 2.43$, SD = 0.44, $M_{store2} = 2.02$, SD = 0.39; $F(1, 2) = 2.78$, $p = .237$, $\eta_p^2 = 0.581$). These findings indicate that the drop-off behavior at the two stores did not differ when no temporal perspective cues were present.

We used all the data to examine the effect of temporal perspective on pro-environmental behavior (means of observations reported in table 3). An ANCOVA test with temporal perspective and stores as two factors (to control for the store effect and the interaction between temporal perspective and stores) and two weekday dummies (to control for the time-fixed effects) as covariates revealed a significant main effect of temporal perspective on drop-off percent ($F(2, 10) = 128.82$, $p < .001$, $\eta_p^2 = 0.963$). Compared with the baseline condition ($M_{baseline} = 1.75$, SD = 0.30), both the cyclical perspective ($M_{cyclical} = 6.39$, SD = 0.38; $t(15) = 16.34$, $p < .001$, $d = 13.541$) and the linear perspective ($M_{linear} = 3.73$, SD = 0.70; $t(15) = 6.97$, $p < .001$, $d = 3.673$) increased the drop-off percent, indicating a boosting effect of advertising the Cardboard Box Return Project on drop-off behavior. More importantly, the drop-off percent in the cyclical condition was higher than that in the linear condition ($t(15) = 9.37$, $p < .001$, $d = 4.721$), supporting hypothesis 1. Moreover, neither the effect of stores ($F(1, 10) = 0.39$, $p = .545$, $\eta_p^2 = 0.038$) nor the interaction effect between stores and temporal perspective cues ($F(2, 10) = 1.81$, $p = .213$, $\eta_p^2 = 0.266$) was significant, showing that the temporal perspective effect did not vary with stores.

An ANCOVA with drop-off customer percent as the dependent variable revealed similar patterns ($F(2, 10) = 118.01$, $p < .001$, $\eta_p^2 = 0.959$). The drop-off customer percent in the baseline condition ($M_{baseline} = 2.22$, SD = 0.43) was lower than that in the cyclical condition ($M_{cyclical} = 7.93$, SD = 0.64; $t(15) = 17.29$, $p < .001$, $d = 10.461$) and that in the linear condition ($M_{linear} = 4.60$, SD = 0.62; $t(15) = 7.19$, $p < .001$, $d = 4.429$). More importantly, the cyclical perspective led to a higher drop-off customer percent than the linear perspective ($t(15) = 10.10$, $p < .001$, $d = 5.295$), supporting hypothesis 1. The drop-off customer percent did not vary with stores ($F(1, 10) = 0.07$, $p = .803$, $\eta_p^2 = 0.007$). We also ran a series of ANCOVA on the

TABLE 3

MEANS OF OBSERVATIONS ACROSS CONDITIONS

Dependent variables (daily)	Conditions								
	Baseline			Cyclical perspective			Linear perspective		
	Store (weeks)		Mean	Store (weeks)		Mean	Store (weeks)		Mean
	Store 1 (week 1)	Store 2 (week 1)		Store 1 (week 3)	Store 2 (week 2)		Store 1 (week 2)	Store 2 (week 3)	
N of pick-ups	749.00	706.00	727.50	780.67	663.33	722.00	831.33	591.33	711.33
N of drop-offs	14.33	11.33	12.83	50.00	42.33	46.17	26.67	24.33	25.50
Paperboard boxes	11.67	6.67	9.17	34.67	31.00	32.83	19.00	19.33	19.17
Plastic bags	2.67	4.67	3.67	15.33	11.33	13.33	7.67	5.00	6.33
Drop-off percent	1.90	1.59	1.75	6.38	6.39	6.39	3.35	4.11	3.73
N of pick-up customers	572	537	554	581.33	527.67	555	599.33	491.00	545
N of drop-off customers	14	11	13	47.33	41.33	44	25.67	23.67	25
Drop-off customer percent	2.43	2.02	2.22	8.03	7.83	7.93	4.37	4.82	4.60

cardboard box and the plastic bag data separately. The results showed that the cyclical perspective promoted both the paper cardboard box and the plastic bag drop-off behavior, compared with the linear perspective and the baseline condition (for details, see web appendix F).

Discussion

The results of the field study provide support for the main effect of temporal perspective on pro-environmental behavior in a real-life retail setting. Customers exposed to the cyclical perspective cue (vs. the linear perspective cue) demonstrated more actual packaging box or bag drop-off behavior. The study provides a strong managerial implication by demonstrating the benefit of using cyclical perspective cues to increase pro-environmental behavior.

STUDY 3: MEDIATING EFFECT OF IES

Study 3 replicated the main effect (hypothesis 1), tested the mediating effect of IES (hypothesis 3), and ruled out two alternative explanations. The study used an incentive-compatible design in which participants were asked to choose between product options and were entered into a draw to win their chosen product. Moreover, as pro-environmental actions are altruistic behaviors that can be driven by prosocial values (White, Habib, and Hardisty 2019), a cyclical temporal perspective may induce a feeling of connectedness with others, which makes people altruistic and thus incidentally increase pro-environmental behavior. We examined this alternative explanation by assessing participants' feelings of connectedness with other people using the Inclusion of Others in the Self (IOS) scale. We also examined whether mood could be an underlying driver for the temporal perspective effect, as a cyclical perspective emphasizing repetition may elicit a negative mood. The negative mood may increase attention to environmental degradation and enhance pro-environmental behavior.

Method

Four hundred undergraduates (42.5% male, M_{age} = 20.31, SD = 2.31) recruited from a Chinese university were randomly assigned to a single-factor (temporal perspective: cyclical vs. linear vs. control) between-subjects experiment in exchange for extra course credit. Seven participants who did not follow the instructions were excluded.

Participants first read material that describes how time passes in daily life. As in study 1, the description of the cyclical temporal perspective emphasized that time repeats itself. In contrast, the description of the linear temporal perspective stated that time is progressive and never goes back (table 2). After reading the description, participants in the cyclical or linear conditions were asked to imagine how time passes and to write sentences about how they benefited from this kind of time and how they lived with it. Participants in the control condition were only asked to recall what they did last week and write about how they felt time passed in their daily life. All participants then reported how they felt time passed on a 9-point semantic differential scale with three items (time is repetitive and cyclical—time is linear and never repeats; time goes in a circle—time moves forward in a straight line; and life is cyclical—life is linear; Cronbach's $\alpha = 0.95$) as a manipulation check for temporal perspective. We also asked participants to assess their current mood with a two-item scale ($r = 0.94$) adapted from Cutright et al. (2011).

Next, participants were asked to imagine that they were planning to purchase a notebook and were considering choosing between two notebook options. The two options, pretested (web appendix G), differ only in their advertised

product features, one highlighting its eco-friendly features (e.g., made of recycled paper, easily degradable) and the other emphasizing its fluent-writing features (e.g., fine paper, no ink bleeds). Participants were told there would be a lottery draw after the study and would get the notebook they chose if they won the lottery.

Participants then rated their perception of IES on a four-item scale (Cronbach's $\alpha = 0.86$, web appendix A), adapted from Martin and Czellar's (2016) EINS scale. The EINS scale uses four visual symbols (overlap between self and nature, distance between self and nature, size of nature, and centrality of nature) to represent the relationship between self and nature. We adapted the EINS scale by using "the environment" instead of "nature," in line with our theorizing. Participants also responded to the measures of IOS (Aron, Aron, and Smollan 1992) on a one-item scale and then provided demographic information. Lottery draws were conducted after participants completed the experiment, and the winners got the notebook they had chosen.

Results

A one-way ANOVA revealed that manipulation of temporal perspective was successful ($F(2, 390) = 89.68$, $p < .001$, $\eta_p^2 = 0.315$). Participants in the linear perspective condition ($M_{linear} = 6.23$, SD = 1.97) were more likely to perceive time as linear than those in the cyclical condition ($M_{cyclical} = 3.09$, SD = 1.93; $t(390) = 12.99$, $p < .001$, $d = 1.608$) and those in the control condition ($M_{control} = 5.39$, SD = 1.90; $t(390) = 3.65$, $p < .001$, $d = 0.445$). The difference between the cyclical time and the control condition was significant ($t(390) = 9.49$, $p < .001$, $d = 1.189$).

Notebook choice was coded (0 = fluent-writing featured notebook; 1 = eco-friendliness featured notebook) as a measure of pro-environmental behavior. A chi-square analysis yielded a significant difference in choice patterns across temporal perspective conditions ($\chi^2(2) = 17.36$, $p < .001$, $\Phi = 0.21$; figure 2). As expected, the percentage of participants who chose a pro-environment featured notebook as the lottery prize in the cyclical perspective condition is higher than those either in the linear condition (59.2% vs. 33.3%; Wald $\chi^2(1) = 16.89$, $p < .001$) or in the control condition (59.2% vs. 44.9%; Wald $\chi^2(1) = 5.33$, $p = .021$), indicating that the cyclical perspective leads to more pro-environmental behavior (hypothesis 1). The difference in the choice pattern between the linear time and the control condition was marginally significant (33.3% vs. 44.9%; Wald $\chi^2(1) = 3.71$, $p = .054$).

A one-way ANOVA showed a significant effect of temporal perspective on IES ($F(2, 390) = 15.75$, $p = .000$, $\eta_p^2 = 0.075$; figure 2). As predicted, participants in the cyclical perspective condition ($M_{cyclical} = 5.11$, SD = 1.29) felt more self-environment inclusion than those in the linear condition ($M_{linear} = 4.20$, SD = 1.34; $t(390) = 5.60$, $p < .001$, $d = 0.69$) and those in the control condition ($M_{control} = 4.59$, SD = 1.30; $t(390) = 3.19$, $p = .002$, $d = 0.40$). The difference between the linear perspective condition and the control condition was also significant ($t(390) = 2.49$, $p = .013$, $d = 0.30$).

Mediation Analyses. To examine the mediating role of IES, we conducted mediation analyses (PROCESS model 4, Hayes 2018) with temporal perspective as the independent variable, notebook choice as the dependent variable, and IES as the mediator. We dummy-coded temporal perspective conditions and used the cyclical perspective condition as the reference group (dummy 1: cyclical perspective = 0, control = 1, linear perspective = 0; dummy 2: cyclical perspective = 0, control = 0, linear perspective = 1). As expected, the results revealed the indirect effects (dummy 1: $b = -0.60$, SE = 0.22, $CI_{95\%} = [-1.07, -0.23]$; dummy 2: $b = -1.06$, SE = 0.25, $CI_{95\%} = [-1.62, -0.63]$) of temporal perspective on notebook choice through IES was significant, with the 95% confidence intervals excluding zero. The direct effects of temporal perspective on notebook choice were not significant (dummy 1: $b = -0.17$, SE = 0.30, $CI_{95\%} = [-0.75, 0.42]$; dummy 2: $b = -0.35$, SE = 0.31, $CI_{95\%} = [-0.97, 0.26]$).

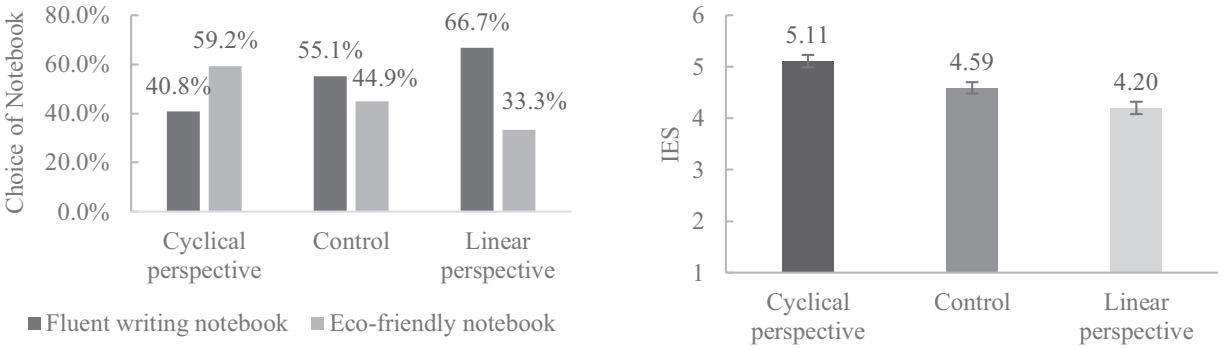
Alternative Explanations. We also tested the possible alternative explanations of the inclusion of others in the self (IOS) and mood. ANOVAs revealed that temporal perspective neither significantly affects IOS ($M_{linear} = 4.36$, SD = 1.54 vs. $M_{cyclical} = 4.57$, SD = 1.56 vs. $M_{control} = 4.40$, SD = 1.60; $F(2, 390) = 0.63$, $p = .535$, $\eta_p^2 = 0.003$) nor affects mood ($M_{linear} = 4.31$, SD = 1.24 vs. $M_{cyclical} = 4.38$, SD = 1.27 vs. $M_{control} = 4.29$, SD = 1.23; $F(2, 390) = 0.17$, $p = .843$, $\eta_p^2 = 0.001$). To test whether these perceptions explained the effect of temporal perspective on pro-environmental behavior, we conducted similar mediation analyses, including IOS and mood as mediators. The results showed that the alternative routes through either IOS (dummy 1: $b = -0.012$, SE = 0.03, $CI_{95\%} = [-0.09, 0.02]$; dummy 2: $b = -0.02$, SE = 0.03, $CI_{95\%} = [-0.10, 0.02]$) or mood were non-significant (dummy 1: $b = -0.01$, SE = 0.02, $CI_{95\%} = [-0.07, 0.03]$; dummy 2: $b = -0.01$, SE = 0.02, $CI_{95\%} = [-0.06, 0.03]$).

Discussion

Study 3 replicated the findings of studies 1 and 2, with a different manipulation of temporal perspective and a measure of *actual* pro-environmental product choice. This study also introduced a control condition; the results in the control condition fell between the cyclical and the linear temporal perspective results. The results demonstrated that the cyclical perspective has a more significant positive effect on pro-environmental behavior than the linear perspective or the control condition. Moreover, this study showed that the linear perspective had a marginally detrimental effect

FIGURE 2

EFFECTS OF TEMPORAL PERSPECTIVE ON CHOICE OF NOTEBOOK AND IES



on pro-environmental behavior compared with the control condition. The findings also support our theorized process mechanism, demonstrating the fully mediational pathway from temporal perspective to pro-environmental behavior through the inclusion of the environment into the self (IES). Finally, the results provide evidence that the effect of temporal perspective on pro-environmental behavior is not due to the differences in the feeling of connectedness to other people or mood.

STUDY 4A: MODERATING EFFECT OF GREEN VALUES

Study 4a used a two-phase study to examine the role of prior green values as a boundary condition for the effect of temporal perspective on pro-environmental behavior (hypothesis 3). This study tested whether the temporal perspective effect is robust using a new temporal perspective manipulation and examined several alternative explanations (IOS, mood, and perceived personal impact on the environment).

Method

Study 4a employed a two-level, single-factor (temporal perspective: linear vs. cyclical) between-subjects design, with prior green values and pro-environmental behavior as measured variables. We conducted the study in two phases that were a week apart to reduce possible demand effects. Prior green values, one of the predictors, were measured in the first phase. Pro-environmental behavior, the criterion variable, was measured in the second phase.

The first phase of the study recruited seven hundred and forty-six Amazon Mechanical Turk workers (55.6% male, M_{age} = 38.99, SD = 11.30). The number of participants was purposively oversampled, considering the potential attrition in the second phase. Participants completed an online survey ostensibly about consumer attitudes. They indicated their green values on a 7-point Green Consumption Values Scale (Haws et al. 2014) with six items (Cronbach's $\alpha = 0.92$).

A week later, all the participants who completed the first-phase task were invited to participate in the second phase of the study. Three hundred and forty-eight participants (56.3% male, M_{age} = 38.28, SD = 10.74) responded to our invitation. They were randomly assigned to either a linear or a cyclical condition. An imbalance check showed that the respondents and the non-respondents did not differ in demographics and prior green values (web appendix I). We excluded three participants who did not complete the dependent variable measure and six who reported different gender information in the two phases. There were a total of 339 participants remaining in our analysis.

We manipulated temporal perspective in the second phase using a specific workout context relating to our daily life experience. After answering two warm-up questions related to exercises, participants were asked to imagine they were going to do exercise workouts with a scheduling approach suggested by experts as a good way to stick to an exercise plan. In the linear condition, participants read an example chart of a scheduling approach in which workouts were scheduled in three boxes arranged horizontally from day 1 to day 3. These boxes are connected with arrows representing the idea that time moves forward. Participants in the cyclical condition were presented with a similar chart, except that the three boxes were connected with arrows in a circle, representing the trajectory of cyclical time (see web appendix A for details). Below, the chart is an explanation of how time passes during the workout schedule (table 2). Next, participants wrote a short essay about how they would do workouts using the scheduling approach and how they felt it was helpful. They also completed the same manipulation check questions as study 3 and reported their mood (Cutright et al. 2011, Cronbach's $\alpha = 0.69$).

Afterward, participants were asked to predict how often they would engage in pro-environmental behavior in the coming 6 months measured by thirteen items that cover a wide range of pro-environmental behaviors from different domains (e.g., electricity/water use, shopping, pro-environmental donation, see web appendix A for details). The scores of the items were averaged to form a pro-environmental behavior index (Cronbach's $\alpha = 0.89$). Then, we measured the inclusion of the environment in the self (IES) adapted from the one-item INS scale (Schultz 2001). We also measured perceived personal impact on the environment using two items, such as "my actions do matter in terms of the natural environment" ($r = 0.89$) as well as IOS (Aron et al. 1992). Finally, we collected participants' general demographic information.

Results

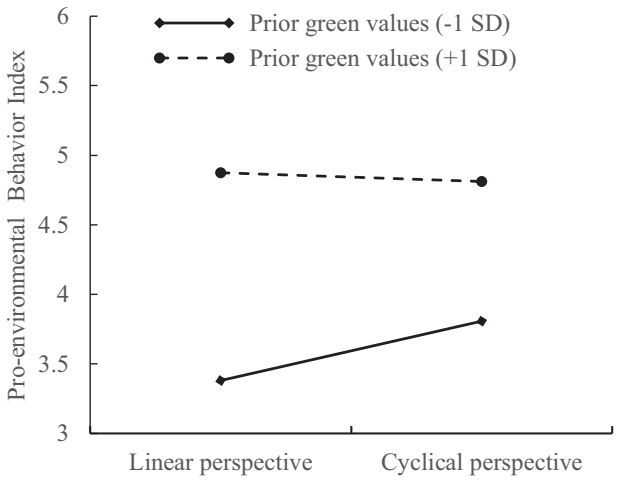
A one-way ANOVA revealed that manipulation of temporal perspective was successful ($F(1, 337) = 215.73$, $p < .001$, $\eta_p^2 = 0.390$). Participants in the linear perspective condition ($M_{linear} = 7.40$, SD = 1.55) were more likely to perceive time as linear than those in the cyclical condition ($M_{cyclical} = 4.28$, SD = 2.29).

A moderation analysis (PROCESS model 1, Hayes 2018) with temporal perspective (0 = linear perspective, 1 = cyclical perspective), prior green values (mean-centered), and their interaction as the predictors and pro-environmental behavior index as the dependent variable yielded a significant main effect of prior green values ($b = 0.55$, SE = 0.04, $t = 13.53$, $p < .001$) and, as predicted, a significant interaction effect ($b = -0.22$, SE = 0.08, $t = -2.71$, $p = .007$). As shown in figure 3, a simple slope analysis revealed that at 1 SD below the mean prior green values score, participants with a cyclical perspective (vs. a linear perspective) were more inclined to do pro-environmental behavior ($b = 0.41$, SE = 0.13, $t = 3.10$, $p = .002$, $CI_{95\%} = [0.15, 0.67]$). In contrast, at 1 SD above the mean prior green values score, no significant difference in willingness to do pro-environmental behavior was detected between the two conditions ($b = -0.10$, SE = 0.13, $t = -0.76$, $p = .447$, $CI_{95\%} = [-0.35, 0.16]$). We further conducted a floodlight analysis using the Johnson-Neyman technique to identify the range of prior green values for which the temporal perspective effect was significant. Results revealed that temporal perspective has a significant effect only for consumers with prior green values less than 4.98 on a 7-point scale ($b = 0.18$, SE = 0.09, $p = .050$), supporting hypothesis 3.

Similar effects were found on IES. A moderation analysis on IES using temporal perspective, prior green values, and their interaction as the predictors yielded a significant main effect of prior green values ($b = 0.63$, SE = 0.07, $t = 9.39$, $p < 0.001$) and a significant interaction effect ($b = -0.29$, SE = 0.14, $t = -2.16$, $p = 0.032$).

FIGURE 3

PRO-ENVIRONMENTAL BEHAVIOR INDEX AS A FUNCTION OF TEMPORAL PERSPECTIVE AND PRIOR GREEN VALUES



Moderated Mediation Analyses. We conducted a moderated mediation analysis (PROCESS model 8, Hayes 2018) with prior green values as a moderator of the temporal perspective effect on pro-environmental behavior through IES. As predicted, the indirect effect ($b = 0.07$, SE = 0.04, $CI_{95\%} = [0.01, 0.14]$) of temporal perspective on pro-environmental behavior through IES was *significant* for participants low in prior green values. In contrast, this mediation disappeared ($b = -0.01$, SE = 0.03, $CI_{95\%} = [-0.07, 0.04]$) for those high in prior green values (+1 SD). The moderated mediation effect remained *significant* when age and gender were included as covariates (see web appendix H for details).

Alternative Explanations. We also examined several alternative processes (IOS, mood, and perceived personal impact on the environment). Results showed that none of the alternatives mediated the effect of temporal perspective on pro-environmental behavior (*indirect effect of IOS* = −0.02, SE = 0.03, $CI_{95\%} = [-0.09, 0.04]$; *indirect effect of mood* = 0.01, SE = 0.02, $CI_{95\%} = [-0.03, 0.05]$; *indirect effect of perceived personal environmental impact* = 0.09, SE = 0.06, $CI_{95\%} = [-0.02, 0.21]$).

Discussion

Consistent with the prior studies, study 4a replicates the effect of temporal perspective on pro-environmental behavior (hypothesis 1). More importantly, the results demonstrate the moderating role of prior green values (hypothesis 3). As hypothesized, temporal perspective influences pro-environmental behavior through IES only

for people not already high on green values. When people already have high pre-existing green values, temporal perspective priming does not significantly affect pro-environmental behavior.

STUDY 4B: REPLICATING THE MODERATING EFFECT OF GREEN VALUES

Study 4b replicated the moderating effect of prior green values (hypothesis 3) with a different operationalization of the major variables in another culture (using a European sample). The study is different from 4a in several ways. First, we operationalized temporal perspective with a more general description. Second, to reduce the possible impact of participants' repetitive behavioral patterns on the pro-environmental behavior measure, the study used consumer preference ratings for eco-friendly products instead of the 13-item pro-environmental behavior index to measure the dependent variable. Third, it replaced the Green Consumption Values Scale in study 4a with a general measure of green values to avoid a possible association between consumption values and product choice. Fourth, given the conceptual similarity between IES and green values, IES was measured using a multi-item scale, allowing us to assess the discriminant validity of IES and green values. Finally, the study tested whether the temporal perspective effect could be generalized to European participants.

In addition, we measured both prior green values and ex post green values to rule out green values as an alternative explanation for our findings. We argue that priming a cyclical perspective activates memories or thoughts directly related to people's experience with the environment (space) and engenders a feeling of connection to the natural environment. However, this process is rapid and temporary, and should not likely transform people's green values, which are formed based on a deliberate process and are more enduring (Kenter et al. 2016). Therefore, we expect that a cyclical perspective increases pro-environmental behavior for people with lower prior green values only through IES rather than through green values. If green values are not significantly changed by temporal perspective, we can have more confidence in our theory.

Method

Study 4b employed a two-level, single-factor (temporal perspective: linear vs. cyclical) between-subjects design. The final sample was comprised of 467 European participants (65.5% female, $M_{age} = 38.56$, SD = 13.40) recruited from Prolific Academic after we excluded 13 workers who did not follow the experimental instructions.

Participants first completed a values survey in which they indicated their green values on a nine-point scale (–1 = opposed to my values; 0 = not important; 7 = very important) adapted from de Groot and Steg's (2008) Value Orientations Scale. The Value Orientations Scale measures the extent to which people consider egoistic, altruistic, and biosphere values are important guiding principles in their life. We averaged the scores of the four items that measure biosphere values (e.g., preventing pollution and protecting natural resources) to form a prior green values index (Cronbach's $\alpha = 0.95$, web appendix A).

After a filler task (a "find the correct shadow" game), participants read either a linear or cyclical time description and wrote sentences as in study 3. Participants' perception of how time passed (our manipulation check) and their mood was measured. Participants then completed three product evaluation tasks, each with a different product category (i.e., mouse, T-shirt, and picture frame). In each task, participants read descriptions of two unbranded product options, one highlighting its pro-environment feature and the other highlighting its good performance feature. The order of each pair of options was randomized. A pretest with 110 participants from the same population showed that the two options were considered similar in many attributes (novelty, high-quality, and variety) except for the pro-environment attribute and the performance attribute (see web appendix J for details). After reading the descriptions, participants indicated their relative preference for the options (1 = definitely prefer option A; 7 = definitely prefer option B), with a higher score representing a greater preference for the pro-environmental product. We averaged participants' relative preference scores in the three tasks to form a pro-environmental behavior index (Cronbach's $\alpha = 0.63$). Then, we measured IES using the same scale as in study 2 (Cronbach's $\alpha = 0.88$). Finally, participants reported their green values again using the same biosphere values scale (Cronbach's $\alpha = 0.97$) and provided general demographic information.

Results

A one-way ANOVA revealed that manipulation of temporal perspective was successful ($F(1, 469) = 252.23$, $p < .001$, $\eta_p^2 = 0.350$). Participants in the linear perspective condition ($M_{linear} = 6.77$, SD = 1.99) were more likely to perceive time as linear than those in the cyclical condition ($M_{cyclical} = 3.60$, SD = 2.33).

As IES and green values are conceptually related, it is important to establish their discriminant validity before conducting the main analyses. We checked discriminant validity by comparing the average variance explained (AVE) for each construct to the average shared variance (ASV) of the two constructs. Results suggest that IES and green values (both prior and ex post values) are conceptually distinct constructs as the AVE scores exceed the ASV score ($AVE_{IES} = 0.82$; $AVE_{prior\ values} = 0.90$; $AVE_{ex\ post\ values} = 0.94$; $ASV_{IES \times prior\ values} = 0.61$; $ASV_{IES \times ex\ post\ values} = 0.65$).

A moderation analysis with temporal perspective (0 = linear perspective, 1 = cyclical perspective), prior green values (mean-centered), and their interaction as the predictors and pro-environmental behavior index as the dependent variable yielded a significant main effect of prior green values ($b = 0.54$, SE $= 0.05$, $t = 11.50$, $p < .001$) and a marginally significant main effect of temporal perspective ($b = 0.18$, SE $= 0.11$, $t = 1.70$, $p = .09$). More importantly, the interaction effect was significant ($b = -0.21$, SE $= 0.07$, $t = 3.13$, $p = .002$), supporting hypothesis 3 again. Simple slope analysis revealed that participants with a cyclical perspective (vs. linear perspective) were more inclined to do pro-environmental behavior ($b = 0.52$, SE $= 0.15$, $t = 3.24$, $p < .001$, $CI_{95\%} = [0.22, 0.82]$) at 1 SD below the mean prior green values score. In contrast, participants showed no significant difference in the pro-environmental behavior index at 1 SD above the mean prior green values score ($b = -0.16$, SE $= 0.15$, $t = -1.02$, $p = .308$, $CI_{95\%} = [-0.45, 0.14]$). Floodlight analysis showed that temporal perspective only significantly affects participants with prior green values less than 6.60 on a 9-point scale ($b = 0.21$, SE $= 0.11$, $p = .050$). We also regressed each relative product preference score on the same predictors and obtained similar patterns (see web appendix K for details).

A moderation analysis on IES using temporal perspective, prior green values, and their interaction as the predictors revealed significant main effects of prior green values ($b = 0.59$, SE $= 0.03$, $t = 17.17$, $p < .001$) and temporal perspective ($b = 0.30$, SE $= 0.08$, $t = 3.84$, $p < .001$), as well as a significant interaction effect ($b = -0.13$, SE $= 0.05$, $t = -2.58$, $p = .010$).

Moderated Mediation Analysis. We conducted a moderated mediation analysis (PROCESS model 8) with prior green values as a moderator of the effect of temporal perspective on pro-environmental behavior through IES. As predicted, the indirect effect ($b = 0.13$, SE $= 0.04$, $CI_{95\%} = [0.05, 0.22]$) of temporal perspective on pro-environmental behavior through IES was *significant* for participants with lower prior green values (−1 SD), whereas this mediation disappeared ($b = 0.03$, SE $= 0.03$, $CI_{95\%} = [-0.03, 0.09]$) for those with higher prior green values (+1 SD). Similar results were obtained when including age and gender or when including prior egoistic and altruistic values as covariates (web appendix K).

Alternative Explanation. The green values measure showed high test–retest reliability ($r = 0.92$). A repeated-measures ANOVA was run, with prior green values and ex post green values as the within-subject measures and temporal perspective as the between-subjects factor. The result revealed a non-significant interaction ($F(1, 465) = 2.59$, $p = .180$), indicating that green values did not significantly differ between the two types of temporal perspective over time. Follow-up ANOVA showed that there was no significant difference between the two types of temporal perspective regarding either prior green values ($F(1, 465) = 0.25$, $p = .621$, $\eta_p^2 = 0.001$) or ex post green values ($F(1, 465) = 1.21$, $p = .272$, $\eta_p^2 = 0.003$). We ran a moderated mediation analysis incorporating prior green values as a moderator of the effect of temporal perspective on pro-environmental behavior through ex post green values. The indirect effect of temporal perspective on pro-environmental behavior through ex post green values was not significant for participants with either high ($b = 0.0017$, SE $= 0.01$, $CI_{95\%} = [-0.01, 0.03]$) or low prior green values ($b = 0.02$, SE $= 0.02$, $CI_{95\%} = [-0.02, 0.06]$). These tests give us confidence in the causal path of temporal perspective to IES to pro-environmental behavior.

Discussion

Using a different manipulation of temporal perspective and a more general measure of green values, study 4b demonstrates again that temporal perspective influences pro-environmental behavior through IES for people who are not already high on green values. The study also distinguishes the role of IES from green values in the relationship between temporal perspective and pro-environmental behavior. Temporal perspective does not significantly affect pro-environmental behavior through IES for individuals with higher green values because of a ceiling effect (green values serve as central beliefs that influence people's self-concept and behavior). However, priming a cyclical perspective can increase IES for those lower in green values because it evokes one's personal experience with the environment. In contrast, priming a cyclical perspective is not likely to increase green values because the change in green values is a deliberate and reflective process. This result indicates that IES, rather than green values, explains the effect of a cyclical (vs. linear) temporal perspective on pro-environmental behavior.

STUDY 5: MODERATING EFFECT OF PROMOTIONAL APPEAL TYPE

Study 5 tested our prediction of the congruence between temporal perspective and promotional appeal on pro-environmental behavior. Specifically, we predicted that an ad uses a benefit-for-the-environment (benefit-for-the-self) appeal that is congruent with consumers' cyclical (vs. linear) temporal perspective leads to more pro-environmental behavior than an ad uses a promotional appeal incongruent with the temporal perspective (hypothesis 4).

Method

Two hundred eighty adults (53.6% male, $M_{age} = 32.16$, SD = 6.92) recruited from the Tencent online survey

platform in China participated in the experiment. Participants were randomly assigned to a 2 (temporal perspective: linear vs. cyclical) × 2 (promotional appeal: self-interested vs. biosphere-interested) between-subjects design.

Participants completed two ostensibly independent tasks. In the first task, we manipulated linear or cyclical temporal perspective as in study 1. Afterward, participants participated in the second task: a new product survey. Participants first read an introduction to a fictitious agricultural product company that had launched a new green product (web appendix L). Then, they saw a poster advertising the product's benefits either for personal health (self-interested appeal) or for environmental protection (biosphere-interested appeal). Next, they reported their purchase intention on a 7-point Likert scale. They also reported their knowledge of green products and purchasing frequency of green products and provided demographic information.

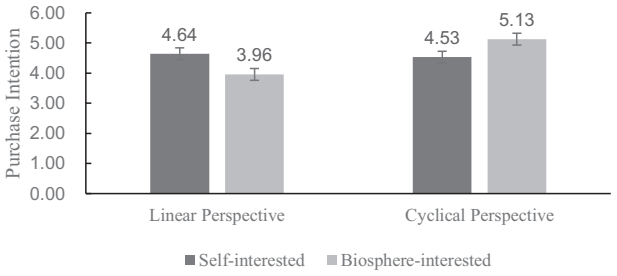
Results

A one-way ANOVA revealed that the manipulation of temporal perspective was successful. Participants in the cyclical condition ($M_{cyclical} = 6.69$, SD = 2.38) were more likely to perceive time as repetitive than those in the linear condition ($M_{linear} = 2.86$, SD = 2.33; $F(1, 278) = 185.80$, $p < .001$, $\eta_p^2 = 0.401$).

A two-way ANOVA revealed a significant main effect of temporal perspective ($F(1, 276) = 7.58$, $p = .006$, $\eta_p^2 = 0.027$) on the green product purchase intention. Most importantly, the analysis revealed a significant interaction effect ($F(1, 276) = 11.21$, $p = .001$, $\eta_p^2 = 0.039$), as predicted in hypothesis 4. Planned contrasts revealed that compared with being presented with a self-interested appeal, participants with a cyclical perspective were more likely to buy the green product advertised with a biosphere-interested appeal ($M_{cyclical\text{-}biosphere} = 5.13$, SD = 1.52; $F(1, 276) = 4.88$, $p = .028$, $\eta_p^2 = 0.017$; figure 4) than with a self-interested appeal ($M_{cyclical\text{-}self} = 4.53$, SD = 1.62). In contrast, participants with a linear perspective were more likely to buy the product advertised with a self-interested appeal ($M_{linear\text{-}self} = 4.64$, SD = 1.63; $F(1, 276) = 6.38$, $p = .012$, $\eta_p^2 = 0.023$; figure 4) than with a biosphere-interested appeal ($M_{linear\text{-}biosphere} = 3.96$, SD = 1.65). Therefore, a match/mismatch between temporal perspective and promotional appeal leads to increased/lowered purchase intentions. An ANOVA including product knowledge and purchase frequency as covariates found similar patterns. The results revealed a main effect of temporal perspective ($F(1, 274) = 8.19$, $p = .005$, $\eta_p^2 = 0.029$), a main effect of purchase frequency ($F(1, 274) = 8.60$, $p = .004$, $\eta_p^2 = 0.030$), and a significant interaction effect between temporal perspective and promotional appeal ($F(1, 274) = 10.65$, $p = .001$, $\eta_p^2 = 0.037$).

FIGURE 4

GREEN PRODUCT PURCHASE INTENTION AS A FUNCTION OF TEMPORAL PERSPECTIVE AND PROMOTIONAL APPEAL



Discussion

Study 5 examined the effect of congruency between promotional appeal and temporal perspective on green product purchase intention. The findings show that consumers with a linear temporal perspective are more willing to purchase a green product that advocates its benefits for humans. In contrast, consumers with a cyclical temporal perspective are more willing to purchase a green product advocating its environmental benefits. In other words, consumers' intentions to purchase green products can be enhanced when the promotional appeal is congruent with their temporal perspective (hypothesis 4). However, an additional measure of the possible spillover effect showed that the congruency effect was specific to the promoted green product and did not extend to a subsequent environmental task (web appendix M). These findings suggest that a congruent promotional appeal only stimulates one's interest in the product; it does not change one's actual environmental attitude. Nevertheless, the main effect of temporal perspective on pro-environmental behavioral intentions remains significant for both the green product purchase and the subsequent pro-environmental tasks, showing a consistent effect that a cyclical perspective leads to higher pro-environmental behavioral intentions.

GENERAL DISCUSSION

Our research shows that temporal perspective affects people's environmental consumption behavior, and this effect is driven by consumers' incorporation of the environment into their sense of self. Six studies conducted in the field, lab, and online, with varied temporal perspective manipulations, demonstrate that the temporal perspective effect is robust across operationalizations and cultures (North America, China, and Europe). The empirical evidence shows that compared with those being primed with a linear temporal perspective, participants primed with a cyclical temporal perspective showed more

environment-related consumption behavior, such as supporting an environmental initiative (study 1), engaging in an environmental project (study 2), choosing or purchasing environmentally friendly products (studies 3, 4b, and 5), and participating in various other pro-environmental behaviors (study 4a). Consistent with our theorizing of the underlying process, our research demonstrates that a cyclical perspective (vs. a linear perspective) increases pro-environmental behavior because it prompts people to incorporate the environment into the self (study 3). Building on the environmental psychology literature, we demonstrate that prior green values, a relatively stable individual trait, act as a boundary condition so that temporal perspective influences pro-environmental behavior through IES only for consumers who are not already very high on prior green values (studies 4a and 4b). We demonstrate that marketers can prime consumers to think of time from a linear or cyclical perspective and provide evidence that using an environmental promotional appeal congruent with consumers' temporal perspective leads to higher pro-environmental intentions (study 5).

Theoretical Implications

Implications for the Pro-Environmental Literature. First, our research advances the literature on sustainable consumer behaviors (White et al. 2019) by revealing that temporal perspective can serve as a novel driver of sustainable consumer behavior change. Previous research on facilitating factors of pro-environmental behavior has focused more on extrinsic incentives and penalties (Kotler 2011) or social influences such as social identities and norms (Chen et al. 2019). However, these measures may sometimes backfire because they reduce individuals' intrinsic motives (Giebelhausen et al. 2016) or threaten their autonomy (Wang, Krishna, and McFerran 2017). Our research demonstrates that consumers can be intrinsically motivated to behave more environmentally because cueing or priming a cyclical temporal perspective facilitates them to include the environment in themselves.

Second, our research contributes to the literature on the broader self-view. Although incorporating outside entities (e.g., the environment) into the extended self can predict pro-environmental behavior (Arnocky, Stroink, and DeCicco 2007), few studies have explored the antecedents (especially non-personal antecedents) of the broader self-view. Our research extends this literature by demonstrating that temporal perspective can influence how people feel their connection with the environment, affecting people's inclusion of the environment into the self.

Third, our findings add to the literature on automatic versus effortful routes to pro-environmental action by examining the mediating role of IES and the boundary condition of green values. Prior work delineates two different routes to action: an automatic route, which is largely feeling-based and is related to rapid and associative processes, and an effortful route, which is cognitive in nature and is associated with slow and deliberative processes (Bardi and Goodwin 2011; Shiv and Fedorikhin 1999). Plenty of work has focused on the effortful route to pro-environmental actions by providing environmental information and knowledge highlighting personal norms or values (Goldstein, Cialdini, and Griskevicius 2008; Kronrod, Grinstein, and Wathieu 2012). However, the effortful route is constrained by many factors, such as information overload (Cheng, Ouyang, and Liu 2020) or psychological reactance to persuasive messages (Clee and Wicklund 1980). We argue that IES is based on a less effortful feeling toward the environment, which is automatically generated from the associative process that temporal perspective induces. This feeling differs from green values because green values often involve norms and principles people judge as important and are reinforced through effortful re-evaluative processes (Maio and Olson 1998). We distinguished IES from green values, showing that temporal perspective influences pro-environmental behavior through IES rather than through green values (study 4b). In this way, our work demonstrates that a cyclical perspective can supplement personal green values because it triggers a feeling of close connection with the natural environment and thus drives individuals with lower green values (those who might be immune to more effortful processing) to act more environmentally.

Implications for the Temporal Perspective Literature. Our research also extends current knowledge on the effect of temporal perspective on human behavior and psychological processes (Saunders et al. 2004; Tam and Dholakia 2014). Behaviorally, prior studies empirically investigate the impact of temporal perspective on saving money (Tam and Dholakia 2014), affective forecasting (Ruscher 2012), and intertemporal choice (Xu et al. 2019). Our work contributes to temporal perspective theory by extending the theory to environmental behaviors. We provide empirical evidence showing the positive role of the cyclical temporal perspective in various sustainable consumption activities (e.g., product purchase and daily use and disposal).

Psychologically, we distinguish differential impacts of linear and cyclical temporal perspectives on one's connection to the environment. People with a cyclical temporal perspective, who view time as repetitive and actions as cumulative, feel that they relate closely to the environment and are more inclined to include the environment in their selves. In contrast, people with a linear perspective, who see time and actions as never repeating, see themselves as separate and distinct from the environment and are less likely to include the environment in their selves. This psychological temporal process explains why people with a cyclical temporal perspective are more sensitive to

eco-centric appeals than those with a linear perspective. The process also helps to explain consumers' consistent pro-environmental behavior across scenarios.

Implications for the Time-Space Synesthesia Literature. More broadly, we contribute to the time-space synesthesia literature by revealing a new psychological connection between the concepts of space and time. Unlike the position-time schema revealed in previous work (Chae and Hoegg 2013), our research explores the perceptual schema underlying the concept of temporal perspective. We establish a link between the understanding of how time moves and the perception of how humans interact with the environment (space). Our work provides new evidence for time–space synesthesia by demonstrating that priming temporal perspective (a sense relating to time) can simultaneously induce how people associate themselves with the environment (a sense relating to space).

Managerial Implications

Our findings have practical implications for marketers. Marketers (or governments) can use temporal perspectives to promote consumers' pro-environmental behavior. For example, marketers could design situational cues, such as pictures or slogans, to prime a cyclical temporal perspective and encourage pro-environmental consumption, especially for consumers low in green values. Marketers could also identify consumers' temporal perspective, perhaps by gleaning relevant information from online search and browsing behavior, and tailor ad contents to be congruent with their temporal perspective. Specifically, for consumers with a linear perspective, firms could use a "benefit for the self" appeal in their environmental initiatives. For those with a cyclical perspective, firms could adopt a "benefit for the environment" appeal. Clever promotional designs could even do both—priming a cyclical temporal perspective (linear temporal perspective) and using a biosphere-interested appeal (self-interested appeal). This way, marketers and policymakers could guide and promote pro-environmental consumption behavior through effective promotions and communications.

Limitations and Future Research Directions

First, as a cyclical perspective is related to repetitive behavior patterns, it may lead people to be more sensitive to those daily routines and activities (e.g., walking and showering) related to pro-environmental behavior (as we showed in study 4a). Although our research shows that a cyclical perspective can also promote non-repetitive pro-environmental behavior (e.g., the choice of eco-friendly products), we did not assess the relative importance of a cyclical perspective in promoting repetitive versus non-repetitive pro-environmental behavior. This fascinating issue could be a direction for future research.

Second, although the linear and cyclical representations of time usually co-exist, and one temporal perspective may be more accessible or salient than the other in specific contexts (as we showed in our studies), there might be differences in the baseline of temporal perspective across cultures and individuals. For instance, Briley (2009) argues that Westerners tend to use a linear perspective, while Easterners are more inclined to use a cyclical perspective. As the concepts of the linear and the cyclical temporal perspectives are widespread in books, movies, and music across time and around the world (Graham 1981), researchers could explore whether temporal perspective can be viewed as a stable characteristic and, if so, how it influences behavior.

Third, although our findings demonstrate converging evidence that a cyclical temporal perspective increases pro-environmental behavior, we noticed that a linear temporal perspective (vs. the control group) had a marginally detrimental effect on pro-environmental behavior (study 3). Future research could investigate possible detrimental consumption aspects of a linear perspective; people with a linear perspective may be unlikely to be closely connected with the current environment and could make less environmentally friendly consumption choices.

Fourth, our research only assumes that time is perceived as either linear or cyclical. However, some researchers have argued for a third perspective: a spiral perspective, where people perceive time moving forward in multiple circles (Ancona et al. 2001; Yamada and Kato 2006). In study 1, we added a spiral perspective as an exploratory condition in which time was described as moving forward in circles. A spiral perspective had an effect similar to a cyclical perspective on pro-environmental behavior (see web appendix C for details). We thus think a spiral perspective might be a special form of a cyclical perspective—people use a spiral metaphor to visualize their perception that the flow of time follows a routinized pattern without conflicting with the knowledge that time moves forward. Although we did not explore this special form further, spiral time seems interesting because it combines the circularity of a cyclical time and the forward momentum of a linear time; it could be further explored.

Finally, we found that a linear (vs. cyclical) perspective led to less inclusion of the environment into the self but not less inclusion of others in the self. This finding supports the idea of time–space synesthesia that temporal perspective as a time concept is more closely linked to the sense of space than people. However, it might also be due to our environment-specific research context. Future research could explore whether temporal perspective influences the feeling of connectedness with other people in other contexts.

DATA COLLECTION INFORMATION

The first author and the fourth author jointly designed studies 1, 2, 3, 4a, 4b, and 5, with feedback from the second and the third authors. The first author and the second author jointly supervised the collection of data for studies 1 and 3, and the fourth author supervised the collection of data for study 2 by research assistants at Wuhan University. The second author collected data for study 5 on Tencent Online Survey. The first author and the third author jointly collected data on MTurk for study 4a, and the first author collected data on Prolific Academic for study 4b. Data reported in studies 1 and 3 were collected at the main library and the behavioral laboratory of Wuhan University in the summer of 2019 and the spring of 2022. Data reported in study 2 were collected at the campus of Wuhan University in the spring of 2021. Data reported in study 5 were collected at the Tencent Online Survey Platform in the summer of 2019. Data reported in studies 4a and 4b were collected on MTurk in the spring of 2021 and on Prolific in the summer of 2022. Data from all studies were analyzed by the second author and discussed by all the authors. The data for all studies is currently stored in a project folder on the Open Science Framework.

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