University of Groningen

Calendars Matter

Peetz, Johanna; Epstude, Kai

Published in:
Social Cognition

DOI:
[10.1521/soco.2016.34.4.1](https://doi.org/10.1521/soco.2016.34.4.1)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Peetz, J., & Epstude, K. (2016). Calendars Matter: Temporal Categories Affect Cognition about Future Time Periods . *Social Cognition*, 34(4), 255-270. <https://doi.org/10.1521/soco.2016.34.4.1>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

CALENDARS MATTER: TEMPORAL CATEGORIES AFFECT COGNITION ABOUT FUTURE TIME PERIODS

Johanna Peetz
Carleton University

Kai Epstude
University of Groningen

Every day, we encounter representations of time in the form of calendars, day planners, and watches. What effect might different structures of time representations have on how we think about the time that is being represented? In four studies, we investigate whether segregation (many temporal categories) or aggregation (few temporal categories) of a time period affects appraisals of the time period itself. Results showed that when a more segregated timeline (Study 1b) or calendar (Study 2) was presented, or if participants chose a more segregated timeline (Study 1a) or calendar (Study 3), the perceived impact of anticipated events during the time period was amplified. Anticipating positive events in a year represented in many temporal categories (e.g., a calendar emphasizing days) led participants to see this year as overall more positive than if the year was represented in few temporal categories (e.g., a calendar emphasizing months).

Every day, we encounter physical representations of time. These range from the watch on our arm and the calendar on our smart phone or computer to wall calendars in our homes. These representations of time can look quite different, but they usually include some form of structure, such as dividing a year into months or weeks, a day into hours. Some days may loom large in these time representations (e.g., birthdays, holidays); some days may be grouped together (e.g., weekdays). What effect might representations of time periods in these different ways have on how we think about the time that is being represented? Does it matter whether we use a monthly or a daily calendar to note down our upcoming anniversary and family members' birthdays? In the present research, we examine possible consequences of structuring a year in many versus fewer temporal categories.

This research was supported by an SSHRC grant to the first author. We thank Erika Sparrow, Jingwen Chen, Aaron Maccosham, and Laura Schellhas for assistance with data collection. Address correspondence to Johanna Peetz, Psychology Department, Carleton University, 1125 Colonel By Drive, K1S5B6 Ottawa, Canada. E-mail: johanna.peetz@carleton.ca.

PERCEIVING ASPECTS OF TIME

Even though it is tempting to think of time as an objective, stable form of measurement (60 minutes to an hour, 365 days to a year), the subjective experience of time is variable. Temporal distance to past or future points in time (Pennington & Roesse, 2003; Wilson & Ross, 2001; 2003), event duration (Sackett, Meyvis, Nelson, Converse, & Sackett, 2010), and connection to events through time (Ersner-Hersfield, Garton, Ballard, Samanez-Larkin & Knutson, 2009; Tu & Soman, 2014) can differ markedly from clock or calendar time. The representation of time plays an important role in determining the subjective experience of time. Visual representations of time periods can shift how people plan to spend this time. For example, visual cues that place a future event in the same temporal category as the present can lead to these events being treated like imminent events. When a calendar was formatted in a way that implied the deadline for a task fell in the same temporal category as the present day (i.e., they shared the same background color), participants intended starting to work on the task sooner than if the calendar was formatted in a way that implied the deadline for a task fell in a different temporal category as the present day (Tu & Soman, 2014). Even changes in the metrics used to describe a time period (e.g., days vs. weeks vs. months until an event) can have effects on people's plans. Time metrics that imply a greater connection to the present (e.g., days to retirement) increased intentions to save money compared to metrics that did not imply such a connection (e.g., years to retirement; Lewis & Oyserman, 2015).

In sum, the representation and mental organization of time is malleable and may shift depending on external cues. People might have stable preferences for a kind of representation, although visual and other cues appear to be able to shift the prevalent type of representation relatively easily (Lewis & Oyserman, 2015; Tu & Soman, 2014). One common feature of time representation is that it tends to be categorical rather than linear. When narrating one's life, time is often represented through metaphors of categories: People tend to organize their life narrative into chapters (Skowronski et al., 2007; Thomsen & Berntsen, 2008) or, in the shorter term, in temporal categories rather than a linear development of temporal selves (Peetz & Wilson, 2013a; Roberts & Feeney, 2009; Skowronski et al., 2007; Tu & Soman, 2014). These temporal categories may be generic—one year may be thought of as "1 year," "12 months," or "365 days"—or personal—one year may be thought of in categories such as "before my birthday," "vacation," and "exam time."

In the present research, we examine the effects of time representations. Specifically, we study whether the number of temporal categories a given time period is divided into matters for people's overall perception of that time period.

TEMPORAL CATEGORIES

A time period such as a year may be mentally divided into different temporal categories—prompted by the metrics used to describe it (e.g., "the next 12 months" vs. "the next year"), visual representations such as calendar formatting (e.g., pages

showing weeks at a time or days at a time), or temporal landmarks (e.g., important events such as birthdays) that create boundaries in the flow of time and mark the beginning of a new temporal category.

Temporal categories can affect the connection between events falling into the same or different categories. Events within the same temporal category are perceived as more similar to each other than events in other temporal categories. A similar pattern exists for temporal representations of the self: Participants perceived a future self as more similar to the present self if both were placed in the same temporal category (i.e., if the category boundary fell after the future self; Peetz & Wilson, 2013b). The start of a new temporal category can signal discontinuity of the self and inspire a change in behavior (Dai, Milkman, & Riis, 2014). Indeed, people might prefer to erect psychological barriers by compartmentalizing negative events or selves in temporal categories different from the present self: Participants preferred to disconnect a dreaded future event by highlighting temporal landmarks that separated this event from the present (Peetz & Wilson, 2013a).

Temporal categories might also serve to structure several events over time in a way that maximizes positivity and minimizes negativity. Outside of the temporal domain, theories on decision making (prospect theory, Kahneman & Tversky, 1979; Thaler, 1985; Tversky & Kahneman, 1991) have suggested that the way decisions are mentally structured can affect overall perceived positivity. Specifically, pleasure can be maximized by separating pleasurable experiences (e.g., financial gains) into several experiences, whereas the pain of negative experiences (e.g., financial losses) can be minimized by integrating these events into fewer experiences to minimize the number of times one experiences loss. For example, Thaler (1985) reported that participants expected someone who won two lotteries with small amounts (\$50 and \$25) to be happier than someone who won once (\$75). Moreover, they thought that someone who had to pay two tax agencies (\$100 and \$50) would be more upset than someone who would have to pay once (\$150). In other words, even though the sum of the positivity of individual events is the same, the number of times events are experienced affects perceived positivity overall. Similarly, structuring events via temporal categories might affect how the individual events people anticipate for a coming time period (e.g., a year) color the perceived positivity of the year overall. Separating events into temporal categories may be akin to experiencing several events, whereas aggregating them into one temporal category may be akin to experiencing only one event.

According to prospect theory, separating positive events represented in many temporal categories might increase subjective overall positivity of an entire time period. Indeed, people's preferences for scheduling positive events reflect this intuition. For hypothetical events in the academic, social, and financial domains, Linville and Fischer (1991) showed that people prefer to separate positive events ("gain savoring"), such that 78% of participants preferred to experience two hypothetical positive events on two separate weekdays rather than on the same weekday. Thus, participants' responses indicated a motivated scheduling of events in a manner that should maximize the positivity of their experience.

We expect that when anticipating *positive* events during a time period (e.g., a year), dividing this year into more temporal categories should increase the overall subjective positivity of the year. Conversely, when anticipating *negative* events during a year, dividing this year into more temporal categories should decrease the overall subjective positivity of the year.

THE PRESENT RESEARCH

We examine possible consequences of temporal categories in time representation in a two-step approach. First, we examine the consequences of temporal categorizations of a given time period (one year) using idiosyncratic temporal categories. Specifically, we asked participants to label temporal categories on a time line representing the future year. Participants either chose the number of temporal categories (Study 1a) or they were randomly assigned to view a timeline with few or many temporal categories (Study 1b). Second, we examined the consequences of temporal categorizations using calendars depicting the next year. Specifically, we asked participants to consider the future year using calendars that emphasized either few or many categories. The type of calendar viewed was randomly assigned to participants (Study 2) or chosen by the participants themselves (Study 3). We examined how the positivity of events anticipated for the next year transferred into participants' overall subjective expectations of positivity for the next year.

STUDY 1

In the first studies, we examined the consequences of structuring a time period—one year—in many or few temporal categories. We expected that greater segregation into categories would increase the impact of anticipated events, such that a year with many anticipated positive events would be seen as overall more positive when it was structured in many temporal categories than when it was structured in few temporal categories. In Study 1a, participants chose their preferred temporal categorization of the next year themselves, and in Study 1b, participants were randomly assigned to visualize the next year either as divided into many temporal categories or as divided into few temporal categories.

STUDY 1A

Participants. We recruited 237 MTurk workers¹ who completed this study in exchange for \$0.50. Of this sample, 11 participants dropped out before answering any dependent variables and were excluded. The final sample included 132 female participants, 93 male participants, and one who declined to reveal their gender ($M_{age} = 36.15$ years, $SD = 12.52$).

1. Given the novelty of the research question, we were aiming for a high sample size to be able to detect even potentially small effects with sufficient power.

Procedure. This study was run in December 2015. Participants were randomly assigned to imagine positive or negative events for the next year: “Now, please think about the most [positive/negative] way in which the next year (2016) might unfold. What might go [right/wrong] next year? Imagine leading a very [happy/unhappy] life in 2016 with [everything/little] going exactly as you wish.” All participants completed this exercise. In the positive condition, participants listed events such as finding a new financially stable job, having a baby, finding a partner, losing weight, and remodeling their home. All participants listed more than one positive event (e.g., “I would become pregnant. I will pass my licensure exam. I will get a better paying job.”). A research assistant coded responses for common themes and found the most commonly mentioned events related to career or finances (81%), family (57%), personal health (27%), and travel (19%); some mentioned events outside their personal life (e.g., a new president of their company, 6%). In the negative condition, participants listed events such as losing a job, home, or car, losing a partner to death or separation, being diagnosed with cancer, and war/natural catastrophes. A research assistant coded responses for common themes, and the most commonly mentioned events related to career and finances (77%), family (44%), personal health (34%), and events outside their personal life (e.g., war, 23%). Participants then completed a manipulation check (“How positive or negative would the next year [2016] be if the events you described earlier actually were to happen?”) on a scale from *Extremely negative* (1) to *Extremely positive* (7). The manipulation check indicated that the manipulation was successful: Participants who imagined positive events rated the year as more positive ($M = 6.40$, $SD = .89$) than participants who imagined negative events ($M = 2.62$, $SD = 1.93$), $t(224) = 19.15$, $p < .001$.

Next, participants specified how they would prefer to mentally structure the next year into temporal categories by choosing one of several versions of a timeline. Specifically, they were instructed that, “People often think about time in ‘chunks’ or ‘categories’. Think about how you might categorize the chunks of time in your life over the next year.” Participants were presented with six different versions of a timeline that extended from *Today* to *A year from today* which had circles drawn on it to represent temporal categories. The first timeline included three circles, the second timeline five circles, the third timeline seven circles, and so on until the sixth timeline included 14 circles. Participants chose the number of temporal categories they preferred and labelled each of the temporal categories. Labels included generic terms (e.g., “Winter, Spring, Summer, Fall, Winter”) or personal plans (e.g., “Steady work flow. Saving money. Moving.”).

Participants were then asked to think about the next year as it will actually transpire and indicate the positivity of this year on two items (“How positive will the next year [2016] actually be for you personally?” “How negative will the next year [2016] actually be for you personally?” (reverse scored) on scales from *Not at all* (1) to *Extremely* (7). These two items were aggregated into an index of next year positivity ($r = .69$). Finally, participants completed a brief demographic survey.²

Results. The timeline participants chose to represent the temporal categories for the next year was independent from event condition, $t(223) = .06$, $p = .953$. The ma-

2. For complete materials for studies 1–3, please refer to the detailed methodology at <https://osf.io/mfhz9/>.

majority of participants chose timelines with 3 categories (28%), 5 categories (32%), or 7 categories (15%), with the remaining timelines chosen about equally frequently.

We next examined how temporal categories structuring a primarily positive or primarily negative year might affect the overall appraisal of the entire year. In a multiple regression (MODPROBE; Hayes & Matthes, 2009), we entered event condition and timeline choice and their interaction term as predictor variables and overall year positivity as dependent variables. All variables were centered. In addition to a main effect of condition, $t(221) = 2.41, p = .017$, and a main effect of temporal categories, $t(221) = 2.90, p = .004$, the interaction term was significant, $t(221) = 2.07, p = .039$ (see Figure 1). When the next year was represented in few categories (1 *SD* below the mean), participants appraised the next year as equally positive regardless of what type of events they had imagined, $t(221) = .24, p = .813$. When the next year was represented in many categories (1 *SD* above the mean), participants appraised the next year as more positive after imagining positive events than after imagining negative events, $t(221) = 3.17, p = .002$.

STUDY 1B

Participants. A total of 156 American and Canadian participants were recruited from Crowdfunder (an online recruitment platform similar to MTurk) for this online study. The sample included 82 female and 74 male participants ($M_{age} = 32.91$ years, $SD = 12.42$).

Procedure. This study was run in July. Participants first completed a brief demographic survey. Then, they were randomly assigned to either think about positive or negative events occurring in the next year, as in Study 1a. However, as the study was run in the middle of the year (July), we defined the “next year” as “the next 12 months” in the instructions, instead of defining it as the next calendar year. All participants completed this exercise. Participants were told to think of their life over the next year in terms of temporal categories, but rather than choosing a timeline, participants were randomly assigned to view a timeline with either three categories (i.e., the timeline contained three circles) or seven categories (i.e., the timeline contained seven circles). Next, participants rated the overall positivity of the next year on the same items as in Study 1a ($r = .67$).

Results. We examined whether structuring the next year as segregated into more versus fewer temporal categories changed how imagining primarily positive or negative events transferred to the overall appraisal of the next year. A 2 (event condition: positive vs. negative) by 2 (temporal categories: three vs. seven) ANOVA showed a main effect of event condition, $F(1, 152) = 11.61, p = .001$, and no main effect of the number of temporal categories, $F(1, 152) = .26, p = .609$. More importantly, the imagery condition by temporal categories interaction term was significant, $F(1, 152) = 5.13, p = .025, d = .56$. Contrasts showed that when the year was represented in many temporal categories, participants appraised next year as overall more positive after imagining positive events than after imagining negative events, $t(152) = 4.12, p = .001, d = .92$. When the year was represented in few categories, participants reported no difference in overall appraisal for the positive and negative imagery conditions, $t(152) = .79, p = .432, d = .16$ (see Figure 1 for means).

FIGURE 1. Projected values for overall year appraisal and mood by event condition when the next year was divided into few (1 SD below mean) vs. many (1 SD above mean) temporal categories (Study 1a) or represented in few (3) vs. many (7) temporal categories (Study 1b).

DISCUSSION

These findings suggest that the number of temporal categories in which a time period is represented can determine how positive this time is perceived overall. Segregating a year in more temporal categories increased the impact that imagined events had on how participants anticipated the positivity of the time period overall. This is in line with participants' intuition that segregating a positive experience into several positive experiences would maximize the pleasure they would gain whereas aggregating a negative experience into as few experiences as possible would minimize the pain they would feel (Thaler, 1985). Temporal categories appear to function as a way to mentally segregate or aggregate events.

There are a number of limitations to these initial studies. First, asking participants to think of the next 12 months (Study 1b) might have primed them with temporal segregation into 12 temporal categories that had to be overridden by the timeline manipulation, reducing the effectiveness of the manipulation. Second, while assigning people to imagine only positive or only negative events increases experimental control, this uniform representation of a future year is not realistic—most people will anticipate both negative and positive events for a future time period. Participants may also have imagined events they did not think likely to occur. Third, while visualizing a year on a timeline may lend itself to closely represent our theoretical distinction between segmented versus aggregated temporal categories, it is not high in mundane realism. People rarely see timelines of the next year, let alone timelines marked with many or few circles. In the next study, we therefore aimed to manipulate the representation of a future year using a more mundane, everyday format: calendars. Calendars represent a medium in which either many temporal categories (e.g., days or weeks) may be emphasized or fewer temporal categories (months, the whole year) may be emphasized. The formatting

of the calendar (coloring, shading, how much time is presented at a glance vs. on different sheets) may affect the number of temporal categories that are implied (see Myrseth & Fishbach, 2009, or Tu & Soman, 2014, for a similar approach).

STUDY 2

In the next study, we presented participants with either a calendar with many temporal categories (emphasizing days, i.e., 365 categories) or with fewer temporal categories (emphasizing months, i.e., 12 categories). In everyday life, people may encounter both types of calendar formats. We expected that the more segmented calendar would again increase the impact that anticipated events during the year would have on the overall appraisal of the year. In addition, we also examined participants' mood to test whether perceiving a time period as primarily positive or negative has actual implications for how people feel in the moment.

Rather than assigning participants to think of hypothetical positive and negative events, we assessed the relative positivity of real events participants actually thought were most likely to occur to them during the next year. We hypothesized that participants viewing the more segmented calendar would report a greater impact of the positivity of anticipated events on their overall appraisal of the year and on their mood, compared to participants viewing the more aggregated calendar. Thus, this study examines the impact of temporal categories on thoughts about the future in a more realistic manner, examining the impact of actually anticipated events and via a common everyday medium such as a calendar.

METHOD

Participants. We recruited 99 participants from the online platform Crowdfunder. The sample included 40 male and 59 female participants ranging in age from 18 to 65 ($M = 38.01$ years, $SD = 12.13$). Note that four participants did not list any events and thus could not be included in the analyses using the event rating variable (3 in the daily calendar condition, 1 in the monthly calendar condition).

Procedure. This study was run in January, to equalize "next year" with a calendar year. After reporting only age and gender, participants were randomly assigned to one of two conditions. Participants were shown a calendar of the upcoming year (see Figure 2) on which either the months (few temporal categories condition) or the days (many temporal categories condition) were separated by lines.

They were asked to "list some events that you expect will happen to you personally next year," and to rate each event's positivity on a scale ranging from *Very negative* (1) to *Very positive* (7). They listed five events, each on a separate page, and the calendar was presented on each page. Events varied in positivity and included events such as "build a new patio," "wedding," "birthday," "son graduating from college in May," "overtime at work," "husband going back to work." We did not expect participants to list uniformly positive or uniformly negative events—in all likelihood everyone's year is a mixture of positive and negative events. Because

FIGURE 2. Calendars representing many (daily) vs. few (monthly) temporal categories (Study 2).

we were interested in the impact across all events on participants’ overall appraisal of the next year, we averaged the rated positivity of the five events into an overall event positivity ($M = 5.98$, $SD = .87$; $\alpha = .53$).

Then participants rated the overall positivity of next year using two items (“Overall, how positive will next year be for you personally?” “Overall, how negative will next year be for you personally?” (r , $r = .52$), on scales ranging from *Not at all positive/negative* (1) to *Extremely positive/negative* (7). Finally, participants completed the PANAS (Watson, Clark, & Tellegen, 1988), as indicator of their present mood ($\alpha = .88$) on scales ranging from *Very slightly or not at all* (1) to *Extremely* (5).

RESULTS

First we examined participants’ overall appraisal of the upcoming year. In a multiple regression (MODPROBE; Hayes & Matthes, 2009), we entered event positivity and calendar condition as predictor variables and the year positivity as dependent variable. All variables were centered. There was a main effect of event positivity, $t(91) = 7.52$, $p = .001$, $d = .74$, no main effect of calendar condition, $t(91) = .44$, $p = .651$, and an interaction of calendar with event positivity, $t(91) = 2.06$, $p = .043$, $d = .43$. As expected, the positivity of the events anticipated for the next year impacted the overall appraisal of the year more when the year was represented in more temporal categories (days emphasized), $t(91) = 7.86$, $p < .001$, than when it was represented in fewer temporal categories (months emphasized), $t(91) = 3.55$, $p = .001$ (see Figure 3).

Next we examined participants’ current mood. Multiple regression showed a main effect of event positivity, $t(90) = 3.07$, $p = .003$, $d = .65$, but no effect of calendar condition, $t(90) = -.17$, $p = .868$, $d = .04$, and no calendar by event positivity interaction, $t(90) = .15$, $p = .879$, $d = .03$. Note, however, that the overall appraisal of the next year was linked to mood in multiple regression, controlling for calendar condition, event positivity, and their interaction, $t(89) = 2.73$, $p = .008$, $d = .58$. Thus, the calendar by event interaction may be said to have an *indirect* effect on mood,

FIGURE 3. Projected values for overall year appraisal and mood when the next year was represented in few (monthly calendar) vs. many (daily calendar) temporal categories, by one standard deviation above and below the mean of event positivity (Study 2).

via the overall appraisal of the year. A bootstrapped test of mediation (Preacher & Hayes, 2008) showed the confidence interval (95%) of the indirect effect of the event positivity by temporal category condition interaction on mood via overall year appraisal to be between -1.11 and -.04. As this interval does not include zero, the effect can be assumed to be significant at $p < .05$.

DISCUSSION

When participants were induced to see the next year in more temporal categories (daily calendar), the events they expected to happen in the next year impacted the overall appraisal of the year more than when they were visualizing next year in fewer temporal categories (monthly calendar). However, the effect was not powerful enough to change participants' mood directly. This may be because participants only listed five events, which is unlikely to be a comprehensive list of all the events they anticipate. Or it may be because participants' natural preferences for structuring time in a particular way overrode the randomly assigned time representations. In the next study, we assess spontaneous calendar preferences and a wider variety of anticipated events.

STUDY 3

In the final study, we assessed participants' spontaneous preference for four levels of temporal categories of a calendar (yearly, monthly, weekly, and daily). Participants also listed a wider array of anticipated events than in the previous study: 10 personal events and 10 events that would occur in the wider world (their city, country, or globally). They again rated their overall appraisal of the next year and their

current mood. We expected that the average positivity of anticipated events would impact their overall appraisal of the entire year more if they chose to represent the year in more temporal categories than if they preferred calendars with fewer temporal categories.

METHOD

Participants. We recruited 100 Canadian undergraduate students who were compensated with partial course credit. The sample included 18 men and 82 women (age 18–34, $M = 20.10$, $SD = 3.05$).

Procedure. This study was run in January. After reporting only age and gender, participants were presented with a choice of four different calendars. These calendars were formatted to emphasize (1) the whole year, (2) the 12 months, (3) the 52 weeks, or (4) the 365 days of the year, achieved via formatting as in Study 2. We coded the calendar choice from 1 (year) to 4 (days). Participants were most likely to choose the daily calendar (52%), followed by the monthly calendar (29%), the yearly calendar (15%), and were least likely to choose the weekly calendar (4%). Participants then explained their choice in their own words.

Next, participants listed 10 events that they expect to happen to them personally next year, including events such as “exams,” “birthday,” “summer job,” and “move out of residence.” Participants also listed 10 events that they expect to happen in their city, country, or the world next year, including events such as “[local sports team] will win,” “Bluesfest” (local festival), “Canada Day,” “Halloween,” “Ebola,” and “the Oscars.” All events were rated on a scale ranging from *Very negative* (1) to *Very positive* (7). The rated positivity of the 10 personal and 10 world events was averaged into an index of average event positivity ($\alpha = .69$).

Participants also rated the overall positivity of the year for themselves personally on two items identical to Study 2 ($r = .62$), and the positivity of the year generally (“Overall, how [positive/negative] will next year be generally,” $r = .46$), on scales ranging from *Not at all positive/negative* (1) to *Extremely positive/negative* (7). These four items were averaged into an index of overall year positivity ($\alpha = .66$). Finally, participants completed the PANAS (Watson, Clark, & Tellegen, 1988; $\alpha = .83$).

RESULTS

First we examined whether the type of calendar participants preferred affected how anticipated events for a future year were linked to the overall appraisal of that year. In multiple regression (MODPROBE; Hayes & Matthes, 2009), we entered event positivity and calendar choice and their interaction term as predictor variables and the overall year positivity as dependent variable. All variables were centered. There was no main effect of event positivity, $t(94) = -.67$, $p = .502$, but a main effect of calendar choice, $t(94) = -2.61$, $p = .010$, which was qualified by a significant interaction of calendar choice with event positivity, $t(94) = 2.59$, $p = .011$, $d = .52$. When participants preferred a calendar with more temporal categories (1 SD above mean), the average positivity of the events anticipated for the next

year impacted the overall year positivity more, $t(94) = 6.04$, $p < .001$, compared to when participants preferred a calendar with fewer temporal categories (1 SD below mean), $t(94) = 1.17$, $p = .243$ (see Figure 4).³

Second, we examined mood. We examined whether the type of calendar affected how anticipated events were linked to participants' current mood. Multiple regressions showed a main effect of event positivity on mood, $t(94) = 2.47$, $p = .016$, and no main effect of calendar choice, $t(94) = .18$, $p = .861$. More importantly, the interaction term was significant, $t(94) = 2.22$, $p = .029$, $d = .46$. When participants preferred a calendar with more temporal categories (1 SD above mean), the average positivity of the events anticipated for the next year impacted participants' mood more, $t(94) = 4.01$, $p < .001$, compared to a calendar with fewer temporal categories (1 SD below mean), $t(94) = .11$, $p = .913$ (see Figure 4).

The overall positivity of the next year was again linked to mood in multiple regression, controlling for calendar choice, average event positivity, and their interaction term, $t(92) = 4.49$, $p < .001$. Thus, the calendar by event interaction may be said to have an indirect effect on mood, via the overall positivity of the year. A bootstrapped test of mediation (Preacher & Hayes, 2008) showed the confidence interval (95%) of the indirect effect of interaction term on mood via overall positivity of the next year to be between .01 and .11. As this interval does not include zero, the effect can be assumed to be significant at $p < .05$.

DISCUSSION

Visualizing the next year in more separate temporal categories increased the impact expected events had on participants' overall appraisal of next year, compared to visualizing it in fewer temporal categories. In turn, anticipating an overall more positive year affected participants' mood in the moment. Unlike Study 2, anticipating mostly positive events for the next year was not solely accountable for positive mood—instead, the positivity of anticipated events affected mood dependent on how the year was represented. Anticipating highly positive events only made participants feel better in the moment if they thought of the year in separate temporal categories, not when the year was aggregated into one temporal category (e.g., year calendar).

GENERAL DISCUSSION

Time can be indicated in many ways (watches, calendars), and different types of such representations may be encountered on a daily basis. The present studies

3. We also examined anticipated personal events and anticipated world events separately. A multiple regression with calendar choice, positivity of *personal* events and their interaction term as predictors, the interaction term significantly predicted positivity of next year for participants personally, $t(92) = 3.42$, $p = .001$. A multiple regression with calendar choice, positivity of *general* events and their interaction term as predictors, the interaction term did not significantly predict positivity of next year generally, $t(83) = .27$, $p = .783$.

FIGURE 4. Projected values for overall year appraisal and mood when the next year was represented in relatively few vs. relatively many temporal categories, by one standard deviation above and below the mean of event positivity (Study 3).

examine potential consequences of time representations, specifically temporal categories. When a year was represented as separated into more temporal categories, events during this time period had a stronger impact on the appraisal of the entire time period, regardless of whether time was represented in everyday type formats (i.e., a calendar, Study 2 and Study 3) or abstractly (i.e., a timeline, Study 1a and Study 1b), whether the time representation was participants' own preference (Study 1a, Study 3) or assigned to them (Study 1b, Study 2). This finding implies that time representation, specifically temporal categories, plays a role in how anticipated events are processed: Thinking of events separately rather than in aggregation might make them loom large. This would mirror how other positive or negative experiences can be experienced differently depending on whether they are mentally aggregated or segregated (Thaler, 1985; Tversky & Kahneman, 1991).

MOOD AND APPRAISAL

In addition to overall appraisal of a given time period, we also examined mood in the moment. Appraising an upcoming year more positively was linked to more positive mood (studies 2 and 3), yet mood was not consistently affected by time representation. Thus, mood may be better conceptualized as a downstream effect of expecting a more or less positive future year.

Note that although measured at the end of the studies, our mood measure may also have captured how positive participants felt upon entering the study, and this initial mood may have affected the kind of events that came to mind. However, even if this was the case, the temporal categories used to mentally organize these events served to amplify or reduce their impact on the positivity of the entire time period. Future research is needed to tease apart the bidirectional effects of mood and appraisal of future events and time periods.

MANAGING MOOD AND APPRAISALS THROUGH TEMPORAL CATEGORIES

Other forms of time perception (e.g., temporal distance to past or future points in time, connections between selves) tend to shift in a way that enhances the present self. Specifically, people tend to push away negative events and selves in order to distance themselves from them and pull positive events and selves close in order to feel better now (Kross & Ayduk, 2011; Peetz, Gunn, & Wilson, 2010; Wilson & Ross, 2001). For example, students felt further away from last term's bad grade than from last term's good grade (Wilson & Ross, 2001); people tend to highlight temporal landmarks before a negative future self, thereby disconnecting the current self from this undesirable identity (Peetz & Wilson, 2013a). Similarly, people might prefer to mentally represent time periods in a way that maximizes positivity. In other words, time periods with many positive events may be structured in more segregated form, so as to maximize positivity, and time periods with many negative events may be structured in a more aggregate form, so as to minimize negativity. There was no evidence of this kind of motivated time perception in Study 1a, however. Other studies in our labs so far suggest mixed evidence for this hypothesis. There might be additional cognitive factors that affect time period categorization, in addition to motivational factors. For example, the construal of categories in the moment might lead people to think of a given future year in terms of large global categories (fewer temporal categories) versus in terms of smaller more specific categories (more temporal categories; Trope & Liberman, 2000). This effect should be independent of valence. Within the construal level approach, valence of a near versus distant time period has received only limited attention. Trope and Liberman (2010) showed that there is a match effect between type of construal and valence. Abstract positive options seem to be linked to distant futures, while more concrete negative options are more inclined to be associated with the more immediate future. From our paradigm, it is difficult to draw inferences regarding near versus distant future representations since the time period was always the same year in the future. Additional research is needed to compare the impact of valence on the perception of a future year.

FUTURE DIRECTIONS

Future research might examine different time periods. We focused on perception of an extended time period (one year). There may be additional effects of the length of the time periods: For very short time periods (e.g., one day), mentally separating negative events might make them more manageable than mentally aggregating them (see participants' stated motivation to avoid "being overwhelmed" by negative events, Linville & Fisher, 1991).

The valence effect shown in the present studies may have important motivational consequences. Being faced with the expectation of a negative versus positive year requires individuals to prepare in different ways. The impact of valence

on goal setting already received considerable attention in psychological research (Brendl & Higgins, 1996). Our findings raise the possibility that the valence-dependent temporal representations may be one way of mental preparation. In line with Brendl and Higgins' (1996) suggestion of the variability of perceived valence, future research may test whether the preference for a certain type of categorization helps individuals motivate themselves to cope with the upcoming year. A negative year with a few categories might seem more manageable, while a positive year with many categories might seem more enjoyable. This may result in more realistic goal setting for the expected year.

Future research might also examine potential interventions using time representations. People tend to be overly optimistic about their future (Robinson & Ryff, 1999; Weinstein, 1980). Instructing people to separate a negative year into many (or a positive year into few) temporal categories might reduce optimistic bias in future thought. On the other hand, representing time in fewer temporal categories might also be useful in helping people cope with overwhelmingly negative outlooks on a particular event or time period.

CONCLUSIONS

Time representations are ubiquitous in our lives. We use watches, calendars, and day planners on a daily basis. The present studies suggest that subtle changes in the way time is represented via these scheduling tools can affect our thoughts and feelings. Specifically, the temporal categories with which a given time period is represented can affect how the time period itself is perceived.

REFERENCES

- Brendl, C. M., & Higgins, E. T. (1996). Principles of judging valence: What makes events positive or negative? *Advances in Experimental Social Psychology*, 28, 95-160.
- Dai, H., Milkman, K. L., & Riis, J. (2014). The fresh start effect: Temporal landmarks motivate aspirational behavior. *Management Science*, 60(10), 2563-2582.
- Ersner-Hersfield, H., Garton, M. T., Ballard, K., Samanez-Larkin, G. R., & Knutson, B. (2009). Don't stop thinking about tomorrow: Individual differences in future self-continuity account for saving. *Judgment and Decision Making*, 4(4), 280.
- Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behavior Research Methods*, 41, 924-936.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 47(2), 263-291.
- Kross, E., & Ayduk, O. (2011). Making meaning out of negative experiences by self-distancing. *Current Directions in Psychological Science*, 20, 187-191.
- Lewis, N. A., & Oyserman, D. (2015). When does the future begin? Time metrics matter, connecting present and future selves. *Psychological Science*, 26(6), 816-825. doi:10.1177/0956797615572231

- Linville, P. W., & Fischer, G. W. (1991). Preferences for separating or combining events. *Journal of Personality and Social Psychology*, 60, 5-23.
- Myrseth, K. O. R., & Fishbach, A. (2009). Self-control a function of knowing when and how to exercise restraint. *Current Directions in Psychological Science*, 18, 247-252.
- Peetz, J., Gunn, G. R., & Wilson, A. E. (2010). Crimes of the past: Defensive temporal distancing in the face of past in-group wrongdoing. *Personality and Social Psychology Bulletin*, 36(5), 598-611.
- Peetz, J., & Wilson, A. E. (2013a). Marking time: Selective use of temporal landmarks as barriers between current and future selves. *Personality and Social Psychology Bulletin*, 40, 44-56.
- Peetz, J., & Wilson, A. E. (2013b). The post-birthday world: Consequences of temporal landmarks for temporal self-appraisal and motivation. *Journal of Personality and Social Psychology*, 104(2), 249.
- Pennington, G. L., & Roese, N. J. (2003). Regulatory focus and temporal distance. *Journal of Experimental Social Psychology*, 39, 1198-1212.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891.
- Roberts, W. A., & Feeney, M. C. (2009). The comparative study of mental time travel. *Trends in Cognitive Sciences*, 13, 271-277.
- Robinson, M. D., & Ryff, C. D. (1999). The role of self-deception in perceptions of past, present, and future happiness. *Personality and Social Psychology Bulletin*, 25, 596-608.
- Sackett, A. M., Meyvis, T., Nelson, L. D., Converse, B. A., & Sackett, A. L. (2010). You're having fun when time flies: The hedonic consequences of subjective time progression. *Psychological Science*, 21(1), 111-117.
- Skowronski, J. J., Ritchie, T. D., Walker, W. R., Betz, A. L., Sedikides, C., Bethencourt, L. A., & Martin, A. L. (2007). Ordering our world: The quest for traces of temporal organization in autobiographical memory. *Journal of Experimental Social Psychology*, 43, 850-856.
- Thaler, R. (1985). Mental accounting and consumer choice. *Marketing Science*, 4, 199-214.
- Thomsen, D. K., & Berntsen, D. (2008). The cultural life script and life story chapters contribute to the reminiscence bump. *Memory*, 16, 420-435.
- Trope, Y., & Liberman, N. (2000). Temporal construal and time-dependent changes in preference. *Journal of Personality and Social Psychology*, 79, 876-889.
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117, 440-463.
- Tu, Y., & Soman, D. (2014). The categorization of time and its impact on task initiation. *Journal of Consumer Research*, 41(3), 810-822.
- Tversky, A., & Kahneman, D. (1991). Loss aversion in riskless choice: A reference-dependent model. *Quarterly Journal of Economics*, 106, 1039-1061.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070.
- Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology*, 39, 806-820.
- Wilson, A. E., & Ross, M. (2001). From chump to champ: People's appraisals of their earlier and present selves. *Journal of Personality and Social Psychology*, 80, 572-584.
- Wilson, A. E., & Ross, M. (2003). The identity function of autobiographical memory: Time is on our side. *Memory*, 11, 137-149.