A time for creativity: How future-oriented schemas facilitate creativity

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Abstract: According to the creative cognition approach, extraordinarily creative ideas are rare because people often generate ideas by retrieving and incrementally modifying concepts from accessible schemas. Grounded in social schema research, we hypothesize that a future-orientation is a means to broaden thinking through activating change and progress schemas, which in turn facilitates creativity. We first offered qualitative evidence that people generally hold a schema that the future is inundated with change and progress. In three experimental studies, we established the creative benefit of future-oriented (vs. present-oriented) thinking in divergent thinking tasks. Further, we offered support that schemas of change and progress mediate the link between future-oriented (vs. present-oriented) thinking and creativity (Study 2) and demonstrated the causal role of schema activation by manipulating accessibility of change and progress schemas under a future-orientation (Study 3). We discuss the implications of how the study of schematic future projections contributes to creative cognition.

Keywords: Creativity, Creative cognition, Future-oriented thinking, Present-oriented thinking, Schema

Discovering a better future rests upon humans' creative capability to steer societal change and progress through scientific breakthrough (Hennessey & Amabile, 2010) and social innovation (Phills, Deiglmeier, & Miller, 2008). Unfortunately, creative ideas are rare because people tend to anchor ideas upon preexisting schemas and knowledge. Grounded in social schema research, we propose that a future-oriented thinking will reduce people's fixation on schemas that are structured around conventionalized knowledge and activate schemas that emphasize change and progress. As a consequence, future-oriented thinking liberates people from preexisting ideas and facilitates creativity.

Creativity entails generating novel and useful ideas (Runco & Jaeger, 2012). According to the creative cognition approach, creativity results from ordinary cognitive processes – retrieving, manipulating, and synthesizing knowledge – directed toward the production of original ideas (Runco & Chand, 1995; Ward, Smith, & Finke, 1999). However, creativity is often limited by structured imagination, a tendency to generate ideas by retrieving and modifying accessible schemas and knowledge. It is unlikely that people consciously adopt this strategy, but the use of familiar schemas often occurs automatically in idea production even when originality is desired (Bink & Marsh, 2000; Ward, Smith, & Vaid, 1997). As a result, it is common for newly developed ideas to schematically resemble preexisting ideas. For a historical example, when trains were first implemented in the 1830s, they were modeled after horse-drawn stagecoaches with conductors sitting outside the cabin. Although the direct transfer of design facilitated rapid implementation of railway travel, the design was not viable because many conductors fell off and were killed (Ward, 2007; White, 1978). In creativity research, participants tasked to design "wildly different" alien animals with 'wings' or 'fins' were often "informed" by typical schemas of birds and fishes to also include 'feathers' and 'scales' as features. Participants also tend to design bilaterally symmetric aliens with two or four limbs and sensory organs typical of those found in earth animals (Ward, 1994; Ward, Patterson, Sifonis, Dodds, & Saunders, 2002; Ward & Sifonis, 1997). Even when atypical features were incorporated, they served similar functions as their earth counterparts (Brédart, Ward, & Marczewski, 1998). Relatedly, the path of least resistance concerns a similar creativity-inhibiting process whereby people tend to generate ideas based on highly accessible exemplars. Exemplars are accessible if they are typical (i.e., they satisfy the ideal of a conceptual domain) and retrievable (i.e., they easily come to mind). For example, taking the path of least resistance, people commonly reference their alien design on a dog, which is a highly accessible animal exemplar (Ward et al., 2002).

Relying on familiar schemas during ideation is ubiquitous, and can severely impede creativity (see Bink & Marsh, 2000). We argue that people could become more creatively prolific if they adhere less to typical schemas and attend more to atypical schemas. Research demonstrated that respondents induced to adopt a "think different" mindset loosened the constraints of typical schemas, enabling higher levels of

divergent thinking (Sassenberg & Moskowitz, 2005; Sassenberg, Moskowitz, Fetterman, & Kessler, 2017). For instance, immersing individuals in schema-violating experiences, such as navigating a virtual reality that defies the laws of physics or reversing the usual procedure of making a sandwich, could enhance their cognitive flexibility (Ritter et al., 2012, 2014). Another recent research demonstrated that novelty seeking promotes creativity (Gocłowska, Ritter, Elliot, & Baas, 2018). In two studies, both trait novelty seeking and experimentally induced state novelty seeking was found to positively predict divergent thinking. Presumably, the higher tendency of novelty seekers to explore unfamiliar stimuli and environments makes them more receptive to experiences that do not conform to existing schemas.

Although social experiences can shape and solidify our schemas, some other social experiences can destabilize the use of schemas and subsequently bring about higher creativity. For instance, immersive multicultural experiences both challenge the validity of one's culturally grounded schemas and broaden one's pool of knowledge to promote creative conceptual expansion (Leung, Maddux, Galinsky, & Chiu, 2008; see also Gocłowska & Crisp, 2014). Hence, exposure to multiple cultures can inspire creativity because it encourages people to adhere less firmly to the common schemas prevalent in their own culture and to adopt new schemas (Leung & Chiu, 2008, 2010). Relatedly, primed exposure to counter-stereotypes (e.g., a female mechanic) can loosen people's use of stereotypes (e.g., mechanics are male), thereby boosting flexible thinking (Gocłowska, Baas, Crisp, & De Dreu, 2014, Gocłowska & Crisp, 2013, Gocłowska, Crisp, & Labuschagne, 2012).

Drawing from these discoveries by schema research, we contend that it could be creativity-facilitating if individuals adhere less to the pervasive schemas that are informed by conventional concepts but adopt those schemas that are informed by unconventional concepts. Activating such schemas could serve as a means to not only destabilize the use of typical ideas, but further help people break set by replacing those typical ideas with novel ideas. In line with the creative cognition approach (Bink & Marsh, 2000; Ward et al., 2002), we argue that thinking in terms of the schemas representing unconventional concepts will produce a more enduring benefit on creativity relative to simply avoiding the schemas representing conventional concepts.

Specifically, we propose that future-oriented thinking is associated with schemas furnished with representations about societal change and progress. Activating these schemas thus makes accessible more unconventional concepts which could facilitate creativity. Several past research substantiated this possibility. For instance, the folk theory of social change (Kashima et al., 2009) showed that people hold relatively fixed implicit beliefs that humankind will progress to become more competent, though less warm toward others. Bain, Hornsey, Bongiorno, Kashima, and Crimston (2013); Bain et al. (2016) similarly showed that people project higher change and progress in the future (e.g., technological, scientific, and societal progress) and these visions of future change could drive pro-environmental and political behaviors in the present. Furthermore, earlier works revealed that people tend to perceive their own future with unrealistic optimism (Taylor & Brown, 1994). Such positive illusions extend to expectations of future societal progress as a way to buffer against existential anxiety and secure a sense of control over the future (Rutjens, van der Pligt, & van Harreveld, 2009; Rutjens, van Harreveld, & van der Pligt, 2010). Based on these findings, we conjecture that future-oriented schemas are predominantly shaped by expectations of change and progress. Therefore, thinking in a future-orientation will bring these unconventional schemas to the fore and benefit creative idea generations.

1. Current research

Together, we propose that future-oriented thinking, through activating schematic representations of change and progress, promotes more creative thoughts. We hypothesize:

H1. Individuals' future-oriented schemas are predominantly characterized by expectations of change and progress.

H2. The future-oriented thinking condition will exhibit higher creativity than the present-oriented thinking condition or control condition.

H3. The effect of future-oriented thinking on creativity is mediated by increased accessibility of schemas associated with change and progress.

We predicted the mediation hypothesis a priori and designed the study being cognizant of the increased validity concern of mediation models (Fiedler, Harris, & Schott, 2018). First, our model is theoretically based. Time-orientation is an exogenous manipulated variable, which through the cognitive process of increasing accessibility of the change and progress schemas, produces a manifest behavior of higher creativity. In contrast, finding the alternative reversed mediation model would empirically reject our hypothesis. That is, showing that future-oriented thinking enhanced creativity, which in turn led to an increased accessibility of the change and progress schemas, would fail to show that bringing to mind a future characterized by high change and progress is the mechanism underpinning the relationship between a future-orientation and creativity. Second, design-wise we manipulated and measured the respective variables according to the temporal order of the hypothesized mediation. Finally, in Study 3 we employed an experimental manipulation to directly activate accessibility of the change and progress schemas, thereby lending support for the causal role of the hypothesized mediator. Thus, we argue that the causal ordering of our predicted mediation model is both theoretically and methodologically grounded.

Across three studies, we employed design tasks as the primary creativity measure. Experts have recommended creative design tasks to enhance ecological validity by capturing novel and practical ideas with higher real-life relevance (Runco & Acar, 2012; Ward, 2007). They also allow objective assessment of whether the ideas deviate from schematic prototypes, which is of particular interest to the current research examining schema accessibility. As a comparison, we also explored the effect of future-oriented thinking on creative insight performance that is dependent on coming up with a known correct solution.

2. Study 1

In Study 1, we sought to confirm the dominance of change and progress concepts in future-oriented schemas and establish that future-oriented thinking facilitates creativity. Across all three studies, we reported all measures, manipulations, and exclusions. For each study, our data collection was limited to a timeframe of one academic semester. All analyses were only conducted after data collection was completed and no additional attempt was made to increase sample size after analyses.

2.1. Preliminary study

A preliminary study was conducted prior to Study 1 to establish that people's future-oriented schemas are predominantly associated with expectations of change and progress. As part of an unrelated study, 67 participants (30% male; M_{age} = 21.12, SD_{age} = 1.85) were given one minute to vividly imagine what human life will be like 50 years in the future. They then listed 20 words associated with the future as they came to mind. Words with similar meanings were first grouped into categories and then summarized into five superordinate themes with either positive or negative valence (see Supplementary Materials, Table S1). Schema accessibility was indexed by *output dominance,* the proportion of total responses coded under a given category (Ward, 2007). As predicted, findings suggest that schemas of the future were predominantly characterized by the superordinate theme of change and progress (34%), with the sub-theme of technological advancement

Table 1
Means and standard deviations (in parentheses) of creativity indices across conditions for Studies 1 to 3.

Condition	Study 1			Study 2			Study 3	
	Future	Present	Control	Future	Present	Control	High Change	Low Change
Novelty	3.65 (0.96)	2.88 (0.95)	2.84 (0.90)	2.78 (1.11)	2.26 (0.90)	2.17 (1.08)	3.84 (1.58)	3.02 (1.46)
Deviance	–	–	–	1.10 (0.71)	0.60 (0.45)	0.69 (0.56)	2.39 (1.69)	1.56 (1.61)
Practicality	3.57 (0.84)	3.65 (0.80)	3.77 (0.81)	3.98 (0.52)	4.01 (0.42)	3.97 (0.18)	3.75 (1.34)	3.19 (1.40)
Fluency	2.26 (0.99)	2.26 (0.98)	2.53 (1.16)	3.15 (2.18)	3.66 (2.20)	3.74 (2.80)	–	–
Insight problem solving	0.46 (0.60)	0.50 (0.56)	0.63 (0.67)	0.60 (0.86)	0.83 (0.77)	0.81 (0.70)	0.23 (0.49)	0.31 (0.50)
RAT score	3.31 (1.75)	3.00 (1.87)	2.55 (1.75)	2.65 (2.04)	2.56 (1.90)	3.42 (1.99)	3.02 (2.18)	3.29 (2.20)

(15%) being mentioned the most. However, it was not uncommon for participants to associate the future with strife (6%), an apocalypse (5%), and a bleak outlook (4%).

2.2. Participants and design

A total of 117 university students participated in Study 1 in exchange for course credits. Due to a technical glitch, two participants did not complete the creativity tasks, resulting in 115 data points (30.4% male; M_{age} = 21.51, SD_{age} = 1.50). Using a between-groups experimental design, participants were randomly assigned to a (1) future-oriented,

(2) present-oriented, or (3) control condition. Administrative and resource constraints prevented us from recruiting the target of 156 participants for 80% power to detect a medium effect (η_p^2 = 0.06). The current sample size has 67% power to detect a medium effect.

2.3. Procedures

2.3.1. Time-orientation manipulation

Participants in the future-oriented (present-oriented) condition were asked to produce a detailed description of the world 50 years in the future (in the present day). The control group did not complete this task. Prior research suggested that 30–50 years is sufficiently distant for people to expect significant changes, yet close enough to project what the society might look like (Bain et al., 2013). The instructions read:

> "In the most vivid details as possible, describe how you perceive people and human life will be [is] like 50 years later in the future [in the present day]. Think about how they spend time on their everyday activities and how they socialize."

Two independent coders who were blind to the research purpose and participants' condition judged the levels of perceived change and progress reflected in participants' writing (1 = *very low* to 4 = *moderate* to 7 = *very high*). To facilitate consistency, coders kept independent logs of example responses they had assigned very low, moderate, or very high scores. The coders' independent judgments showed high inter-rater reliability (*ICC* = *0.*76).

2.3.2. Affect

Due to the link between positive affect with creativity (Baas, De Dreu, & Nijstad, 2008), and optimism for the future (Taylor & Brown, 1994), we measured affect as a covariate with the PANAS (Watson, Clark, & Tellegen, 1988). Both positive (α = .79) and negative affect (α = .94) did not differ across conditions, $F(2, 112) = 0.46$, $p = .63$ and $F(2, 112) = 0.84$, $p = .43$ respectively, nor did they correlate with any creativity index (see Table S2a). These affect measures will not be discussed further.

2.3.3. Creative design task

The primary measure of creativity is a toy design task adapted from Smith, Ward, and Schumacher (1993). Participants were given 10 min to design as many creative toys as possible (see Supplementary Materials for full instructions). Two independent coders who were blind to the research purpose and participants' condition scored each idea on two dimensions: (1) novelty – the extent that the design is original or deviates from existing toys in the market, (2) practicality – the extent that the design serves its purpose (e.g., fun, educational) and is appropriate (e.g., safe, suitable for its audience). Both dimensions were coded on a 1 (*very low*) to 7 (*very high*) scale. Coders were instructed to judge ideas based on first impressions as if they saw the given design in a store. After an initial round of coding, the *ICC* for the two dimensions were .54 and .42. A third coder discussed disagreements exceeding two points with the two initial coders and independently provided a third set of coding. The final novelty and practicality scores of a given participant were computed by averaging the respective scores across all of his/her ideas evaluated by the three coders ($ICC_{novelty}$ = .89, & $ICC_{practicality}$ = .76).

2.3.4. Creative insight tasks

Participants were given three creative insight problems (Schooler, Ohlsson, & Brooks, 1993) to solve within 90 s per problem (see Supplementary Materials). In addition, participants were given a 10-item Remote Associates Task (RAT) to complete in three minutes. The RAT is considered an insight task with a correct solution, which is the target word that connects three other seemingly unrelated words (e.g., fish, mine, rush; the answer is gold). This task requires the ability to search for the non-dominant meanings of the conceptually distant words and then to narrow down the possibilities to one solution (Smith, Huber, & Vul, 2013).

2.4. Results

To recap, our first hypothesis predicts that the perception of the future relative to the present is dominated with higher expectations of change and progress. We analyzed coders' ratings of participants' open-ended responses to the future- and present-oriented manipulation (*ICC* = .76). An independent *t*-test confirmed that societal change and progress was mentioned to a greater extent in the future-oriented condition (M = 4.45, SD = 1.84) than in the present-oriented condition (M = 1.50, SD = 0.75), $t(75) = 9.15$, $p < .001$, $d = 2.10$, 95% CI_{diff} [2.31, 3.59]. Next, we tested whether the participants in the future-oriented condition performed more creatively than did those in the present-oriented and control conditions. The descriptive statistics for all creativity indices in Studies 1 to 3 are summarized in Table 1.

2.4.1. Novelty

Results showed a significant main effect of future- versus present-orientation on the novelty dimension of the toy design task, $F(2, 112) = 9.14$, $p < .001$, $\eta_p^2 = .14$. As hypothesized, participants produced more novel ideas in the future-oriented condition (M = 3.65, SD = 0.96) than did those in the present-oriented (M = 2.88, SD = 0.95; $g = 0.82$[1], 95% CI_{diff} [0.35, 1.19]) or control condition (M = 2.84, SD = 0.90; g = 0.96, 95% CI_{diff} [0.39, 1.23]), both p's <

[1] We report Hedges' *g* as the effect size of a pairwise comparison, which is akin to Cohen's *d* but weighted according to relative sample sizes across conditions. In the case where sample sizes across conditions are equal, *g* equals *d*.

.001. The novelty scores in the present-oriented and control condition did not differ from each other ($t(112) = 0.18$, $p = .86$).

2.4.2. Practicality

The main effect of time-orientation on the practicality dimension was not significant $F(2, 112) = 0.55$, $p = .58$. Participants in the future-oriented ($M = 3.57$, $SD = 0.84$), present-oriented ($M = 3.65$, $SD = 0.80$), and control condition ($M = 3.77$, $SD = 0.81$) produced ideas with similar levels of practicality (t's$(112) < 1.03$, p's $> .30$).

2.4.3. Fluency

The fluency of ideas was similar across conditions, $F(2, 112) = 0.83$, $p = .44$. Participants in the future-oriented ($M = 2.26$, $SD = 0.99$), present-oriented ($M = 2.26$, $SD = 0.98$), and control condition ($M = 2.53$, $SD = 1.16$) produced similar number of toy designs (t's $(112) < 1.30$, p's > 0.26).

2.4.4. Insight problem solving

There was no main effect of time-orientation on performance in insight problem solving, $F(2, 112) = 0.81$, $p = .45$. Participants in the future-oriented ($M = 0.46$, $SD = 0.60$), present-oriented ($M = 0.50$, $SD = 0.56$), and control condition ($M = 0.63$, $SD = 0.67$) solved similar number of insight problems (t's$(112) < 1.22$ p's > 0.23). Similarly, there was no main effect on the RAT performance, $F(2, 112) = 1.73$, $p = .18$. Results suggested a trend that future-oriented participants solved more RAT problems ($M = 3.31$, $SD = 1.75$) than control condition participants ($M = 2.55$, $SD = 1.75$; $t(112) = 1.85$, $p = .07$). However, the future-oriented participants did not outperform the present-oriented participants ($M = 3.00$, $SD = 1.87$; $t(112) = 0.75$, $p = .45$). RAT performance also did not differ between the present-oriented condition and control condition ($t(112) < 1.09$, $p = .28$).

2.5. Discussion

Results support our conjecture that people schematically expect much change and progress in future societies. Future-oriented thinking facilitated divergent thinking, evidenced through participants' more novel toy designs. However, future-oriented thinking did not benefit performance on insight tasks that attest to searching for a correct answer.

3. Study 2

Study 2 extended Study 1 in two aspects. First, Study 2 further tests the robustness of our findings with different measures of schema accessibility and creativity. Mediation analyses were not viable in Study 1 because schema accessibility was inferred from responses to the time-orientation manipulation and was not measured separately. Therefore, Study 2 employed a separate scale capturing participants' schematic perception of societal attributes. Second, in addition to the variable of time orientation (present vs. future), we included a second variable of priming context (the everyday social activity context used in Study 1 vs. the consumer product context) to test if the creativity-enhancing effect of a future-orientation could be strengthened if participants were primed to focus on a context directly relevant to the subsequent creativity task (i.e., the consumer product context).

3.1. Participants and Design

University students ($N = 152$, 28% male; $M_{age} = 21.88$, $SD_{age} = 1.87$) participated in the study in exchange for 5 Singapore dollars. No data points were removed. A between-groups experiment with a partially-crossed factorial design (2 × 2 with an added control group) was employed. The first factor pertains to time-orientation (present-oriented vs. future-oriented). The second factor pertains to the priming context (general social life vs. consumer product context). The sample size has 79.4% power to detect a medium effect ($\eta_p^2 = .06$), and 99.6% power to detect an effect size similar to Study 1 ($\eta_p^2 = 0.14$).

3.2. Procedures

3.2.1. Time-orientation manipulation

Identical to Study 1, participants were randomly assigned to a (1) future-oriented, (2) present-oriented, or (3) control condition. The future- and present-oriented conditions were further divided into two priming contexts, one focusing on everyday social activities (per Study 1) and another focusing on consumer products and technologies. We included the second context to test if the creativity-enhancing effect of a future-orientation could be strengthened by activating a consumer product context that has more direct relevance to the subsequent creativity task (designing a dining table). In the condition emphasizing a consumer product context, the instructions read:

> "In the most vivid details as possible, describe how you perceive people and human life will be [is] like 50 years later in the future [in the present day]. Think about the consumer products and technologies that they have access to."

3.2.2. Manipulation booster

As the time gap between the initial manipulation and the creativity tasks was longer in Study 2, a booster prime was included before the creativity tasks. Participants were asked to write two short sentences about the most prominent thing that came to their mind when they completed the time-orientation manipulation task.

3.2.3. Schema accessibility

Participants in the priming conditions responded to a "Societal Perception Scale" (adapted from Bain et al., 2013) measuring their projections of certain attributes (e.g., scientific progress, crime) in society. Additional items were developed based on participants' common projections of present and future societies in Study 1 (e.g., rapid change, novelty, aging population, social isolation). Depending on their condition, participants rated the extent that a list of qualities "characterize human life and the society 50 years in the future [in the present day]" on a 9-point scale (1 = *extremely uncharacteristic,* 9 = *extremely characteristic*). Until now, we have focused on the schema of change and progress. However, we note that past research also identified other projected schemas about the future which may influence people's thinking and behaviors (Bain et al., 2013, 2016). We also measured these other accessible thoughts to show that the benefit of future-oriented thinking on creativity is uniquely mediated through accessibility of change and progress. These attributes are organized into six factors: (1) change and progress, (2) social community, (3) societal dysfunction, (4) warmth, (5) morality, and (6) competence (see Table 2 for items). Extending Bain et al. (2013)'s original categorization, we separated the factor of societal development into two factors, namely, change and progress and social community for a more focused test. Change and progress is the factor of interest here, reflecting perceptions of innovation, progress, novelty, and change in society. In contrast, the social community factor reflects perceived communal inclusivity and prosociality. These factors are empirically independent, $r = -.05$, $p = .62$.

A factor analysis was conducted to evaluate the reliability and validity of the schema accessibility measure. Each item was loaded on one of the six hypothesized orthogonal factors described above. To obtain an optimal set of items to measure each factor, only items with a standardized loading > 0.50 were retained. The final model exhibits satisfactory fit indices (Hu & Bentler, 1999), with RMSEA = .078, CFI = .91, and $\chi^2(177) = 305.76$. All factors exhibited good construct reliability (CR) as assessed with Joreskog $\rho > .70$ (see Table 2).

Table 2
CFA results for the societal perception scale in Studies 2 and 3.

Factor/Item	Standardized loading	
	Study 2	Study 3
Change and progress	CR = 0.81	CR = 0.93
Technological innovation	0.60	0.95
Scientific progress	0.70	0.96
Novelty*	0.58	0.66
Progress and advancement*	0.89	0.94
Rapid change*	0.58	0.73
Social community	CR = 0.84	CR = 0.90
Inclusive communities*	0.73	0.88
Social welfare	0.79	0.91
Volunteerism	0.85	0.72
Positive change*	0.62	0.79
Diversity*	–	–
Societal dysfunction	CR = 0.87	CR = 0.87
Terrorism and Crime	0.55	0.53
Resource depletion	0.80	0.91
Global warming	0.94	0.93
Aging population*	0.84	0.74
Poverty	–	–
Gender inequality	–	–
Prejudice and discrimination*	–	–
Corruption	–	–
Diseases	–	–
Environmental protection*	–	–
Warmth	CR = 0.94	CR = 0.95
Warmth (relationships)	0.96	0.92
Caring	0.93	0.99
Unfriendliness	–	–
Insensitivity	–	–
Social isolation*	–	–
Morality	CR = 0.93	CR = 0.93
Honesty	0.88	0.88
Sincerity	0.95	0.92
Trustworthiness	0.86	0.91
Immorality	–	–
Deceitfulness	–	–
Competence	CR = 0.83	CR = 0.90
Competence	0.82	0.76
Achievement	0.99	0.96
Resourcefulness*	0.50	0.86
Laziness	–	–
Incompetence	–	–

Note:
* Indicates an item created for this study based on Study 1's data. Dashes (−) indicate that an administered item was removed due to a standardized loading of < 0.50.

3.2.4. Affect

The PANAS was included per Study 1. Neither positive (α = .89) nor negative affect (α = .90) differed across conditions, $F(2, 149) = 1.74$, $p = .18$ and $F(2, 149) = 1.78$, $p = .17$ respectively. Moreover, neither positive nor negative affect scores were correlated with the creativity indices, except for the practicality and RAT scores (see Table S2b.). These affect measures were not significant covariates and including them in the model did not change the results, hence they are not discussed further.

3.2.5. Creative design task

Whereas the toy design task in Study 1 did not require the toys to meet certain specifications, participants in Study 2 were required to design “dining tables for a family of four”. Participants had 10 min to produce as many designs as they could (see Supplementary Materials for instructions). As most people will hold a highly prototypical schema for dining tables (e.g., symmetrical with legs and a flat surface), the task is creatively challenging and provides a stronger test of the schema accessibility hypothesis. This task also allows an objective scoring procedure through evaluating the number of design features that deviate from schematic prototypes of dining tables. Whereas the nature of the task resonates with the well-established alien drawing task (Ward, 1994), it has the added advantage of assessing practicality of the designs beyond merely capturing creative imagination.

Per Study 1, two independent coders blind to the research purpose and participants' condition scored each idea on dimensions of *novelty* and *practicality* on a 7-point scale (1 = *very low* to 4 = *average* to 7 = *very high*). Additionally, coders evaluated *deviance* (range from 0 to 5), which is an objective count of design features that deviate from typical schemas of dining tables. Demonstrating each of the following attributes in the design can score one point: (1) asymmetry, (2) unconventional shape (e.g., not circular or rectangular), (3) unconventional size, (4) unconventional theme (e.g., dining on hammocks, dining in an underwater aquarium), (5) multifunctional with added function(s) atypical of a dining table (e.g., built-in refrigeration, built-in computer). Thus, deviance captures the extent that participants creatively broke free from the constraints of existing schemas of dining tables. Satisfactory inter-rater consistency was achieved with one round of coding ($ICC_{novelty} = .78$, $ICC_{practicality} = .70$, $ICC_{deviance} = .88$). The final score for each of the three dimensions of a given participant's designs was computed by averaging the respective novelty, practicality, and deviance ratings across all of his/her ideas evaluated by the two coders.

3.2.6. Insight problem solving

For comparison purpose, participants completed the same RAT items and the three insight problems as per Study 1.

3.3. Results

We first analyzed creative performance in the dining table design task with a series of two-way ANOVAs. Consistent with Hypothesis 2, a future-orientation facilitated creativity in terms of the designs' novelty and schema deviance. However, the main effect of the priming context (i.e., social activities vs. consumer products) and its interaction effect with time-orientation (i.e., present-oriented vs. future-oriented) were not significant on the novelty and schema deviance scores (see Supplementary Materials, Table S3). Thus, we collapsed the data across priming contexts and conducted one-way ANOVAs focusing on the main effect of time-orientation.

3.3.1. Novelty

The main effect of time-orientation on the designs' novelty was significant, $F(2, 149) = 5.48$, $p = .005$, $\eta_p^2 = .07$. As hypothesized, pairwise comparisons revealed that more novel ideas were produced in the future-oriented condition ($M = 2.78$, $SD = 1.11$) than in the present-oriented ($M = 2.26$, $SD = 0.90$; $p = .006$, $g = 0.52$, 95% CI_{diff} [0.16, 0.89]) and the control condition ($M = 2.17$, $SD = 1.08$; $p = .007$, $g = 0.60$, 95% CI_{diff} [0.17, 1.07]). The novelty scores did not differ between the present-oriented and control condition ($t(149) = 0.41$, $p = .68$).

3.3.2. Deviance

The main effect of time-orientation on the designs' deviance was significant, $F(2, 149) = 11.59$, $p < .001$, $\eta_p^2 = .13$. As predicted, participants in the future-oriented condition ($M = 1.10$, $SD = 0.71$) produced designs that deviated more from a typical dining table than did those in the present-oriented ($M = 0.60$, $SD = 0.45$; $p < .001$, $g = 0.84$, 95% CI_{diff} [0.29, 0.71]) and the control condition ($M = 0.69$, $SD = 0.56$; $p = .002$, $g = 0.62$, 95% CI_{diff} [0.15, 0.66]). The deviance scores between the present-oriented and the control condition did not differ from each other ($t(149) = -0.73$, $p = .47$).

3.3.3. Practicality and fluency

The main effect of time-orientation on the designs' practicality was not significant, $F(2,149) = 0.14$, $p = .87$. The main effect of time-orientation on idea fluency was also not significant, $F(2, 149) = 1.01$,

$p = .37$.

3.3.4. Mediation analyses

As the pattern of the time-orientation main effect was consistent across the novelty and deviance dimensions (both tapping on divergent thinking), and both indices are highly interrelated ($r = .78$), an overall creativity index was created to test the mediation model by averaging their standardized scores.

In both Studies 2 and 3, we used the SPSS PROCESS Macro (Preacher & Hayes, 2004) to conduct the mediation analyses. First, the mediator was regressed on the independent variable. Second, the dependent variable was regressed on the independent variable and mediator simultaneously. The standard errors and confidence intervals of the indirect effect were then estimated using bootstrapping with 1000 sampling iterations. In the current study, time-orientation was dummy-coded (1 = *future-oriented thinking*, 0 = *present-oriented thinking*). The control condition was excluded from the mediation analyses because this condition did not include the attribute rating task that measures the mediator of schema accessibility.

To recap, Hypothesis 3 predicts that the creativity-facilitating effect of future-orientation is mediated through increased accessibility of the change and progress schemas, which was measured by participants' ratings on the extent to which a list of attributes (e.g., change and progress, perceived warmth) are characteristic of the future or present societies. All six factors (i.e., change and progress, perceived warmth, morality, competence, social community, and societal dysfunction) were included in initial analyses as parallel mediators in the relationship between time-orientation and creativity. We note that the future-oriented thinking prime did affect the accessibility of schemas other than change and progress (see Supplementary Table S4a). Specifically, people's accessible thoughts of the future were associated with a lower sense of social community ($B = -0.82$, $SE = 0.24$, $p = .001$), benevolence ($B = -1.11$, $SE = 0.24$, $p < .001$), and competence ($B = -0.44$, $SE = 0.22$, $p = .045$) relative to their thoughts of the present. However, only change and progress uniquely mediated the creative benefit of future-oriented thinking as the other factors did not predict creativity (see Supplementary Tables S4b) and were therefore removed from the final model.

The hypothesized mediation model supports that future-oriented thinking promoted creativity through the accessibility of societal change and progress schemas. In the first path, a future-orientation predicted higher ratings of change and progress ($B = 0.41$, $t = 2.36$, $p = .020$, 95% CI [0.07, 0.75]). In the second path, perceptions of change and progress predicted higher creativity ($B = 0.20$, $t = 2.44$; $p = .016$, 95% CI [0.04, 0.37]). The direct effect of future-orientation on creativity remained significant ($B = 0.55$, $t = 3.43$, $p < .001$, 95% CI [0.24, 0.88]), suggesting a partial mediation. The bootstrapped results support a significant indirect effect of future-orientation on creativity through the mediation of perceptions of change and progress ($B_{\text{Indirect}} = 0.08$, $SE_{\text{Boot}} = 0.05$, 95% CI_{Boot} [0.02, 0.23]). The effect size of the mediation is $P_M = .13$ (the ratio of the indirect effect to the total effect; Wen & Fan, 2015).

3.3.5. Insight problem solving and RAT

The main effect of future-orientation was neither significant on performance on the insight problems ($F(2,149) = 1.53$, $p = .22$), nor the RAT (F (2, 149) = 1.49, $p = .23$).

3.4. Discussion

With a different creativity task, Study 2 replicates the creative benefit of future-oriented thinking, as reflected in higher levels of (subjectively rated) novelty and (objectively coded) schema deviance. Study 2 further established that this creative benefit is mediated through increased accessibility of the change and progress schemas under future-oriented thinking. Like Study 1, future-oriented thinking did not benefit creative insight. Priming a context (consumer products) more relevant to the design task also did not accentuate participants' creative advantage. This suggests that the creativity-enhancing effect of future-orientation was not context-specific in our study. Instead, future-orientation may activate thoughts about change and progress generally, which in turn promotes creative thinking. However, we also caution that the role of priming context may not be completely ruled out, as our sample size (approximately 30 per cell) may not be well- powered enough to detect the interaction effect between priming context and future-oriented thinking.

4. Study 3

We had shown that future-oriented thinking facilitates creativity by activating change and progress schemas. To provide more robust evidence, Study 3 seeks to establish the causal role of the change and progress schemas on creativity by experimentally manipulating participants' perceived levels of future change and progress.

4.1. Participants and design

University students ($N = 124$, 25% male; $M_{\text{age}} = 20.64$, $SD_{\text{age}} = 1.74$) participated in the study in exchange for course credits. No data points were removed. The study employed a between-groups experiment with two randomly assigned conditions: priming future-orientation with high levels of change versus low levels of change. In Study 2, the smallest effect size of interest was $\eta_p^2 = .07$. The current sample provided an 86% power to detect an effect of this size.

4.2. Procedures

4.2.1. Time-orientation induction

Participants were randomly assigned to think of a future with either very high or very low levels of change and progress. The instructions read:

> "Imagine the world 50 years later in the future that is characterized by very high [very low] levels of change and progress. Think of aspects of human life and the world that will advance to become radically different [are fundamentally unchanging and will remain similar]. In the most vivid details as possible, describe your perceptions of people and human life in this world 50 years from now, and why this version of the future might happen."

4.2.2. Schema accessibility

Similar to Study 2, participants then responded to the "Societal Perception Scale". With the same items, CFA showed satisfactory fit (RMSEA = 0.075, CFI = .94, $\chi^2(177) = 300.94$) and composite reliability (CR > .70; see Table 2).

4.2.3. Affect measure

Next, participants completed the PANAS. Both positive ($\alpha = .90$) and negative affect ($\alpha = .94$) scores were similar across conditions $t(122) = 1.47$, $p = .14$ and $t(122) = -0.08$, $p = .93$ respectively, and unrelated to creativity (see Table S2c).

4.2.4. Creative design task

We adapted the established alien creature design task to measure creativity (Ward, 1994; Ward et al., 2002). To avoid participants thinking of a different planet, which could undo the earlier priming manipulation, we had participants generate an imaginary creature to appear in a movie (see Supplementary Materials). They also had to describe what the creature actually is and summarize its key characteristics.

Per earlier studies, two independent coders blind to the research purpose and participants' condition judged each idea's novelty and

practicality on a 7-point scale (1 = *very low* to 4 = *average* to 7 = *very high*). Novelty is defined similarly as earlier studies, whereas practicality is defined as the likelihood that the creature design is useful for a movie. Deviance, the extent to which an idea deviates from prototypical earth animals was coded based on an established coding scheme (Ward, 1994; Ward et al., 2002). Each design was coded for the presence of unusual appendages (e.g., wings, legs, arms, tails, horns) and unusual sense organs (e.g., eyes, ears, mouth, nose, skin) or sensory ability. A feature is unusual if it is atypical of earth animals or exhibits a novel use of an otherwise common feature of earth animals (e.g., taking nourishment through the legs). Each design was also coded for the presence of bilateral asymmetry (0 = *symmetrical*, 1 = *some asymmetrical features*, 2 = *highly asymmetrical overall design*). The deviance score is the sum of the total number of unusual features and the bilateral asymmetry coding. Coders were mindful to distinguish poor artistic ability from intentionally unusual or asymmetrical designs, which were often labeled by the participants. Good inter-rater reliability ratings were achieved after one round of coding ($ICC_{\text{novelty}} = .89$, $ICC_{\text{practicality}} = .81$, $ICC_{\text{deviance}} = 0.90$).

4.2.5. Insight problems and RAT

Creative insight was measured with the same three insight problems and 10-item RAT as Studies 1 and 2.

4.3. Results

4.3.1. Manipulation check

To ensure that the manipulation induced different levels of perceived change and progress in the future, two independent coders who were blind to the research purpose and condition scored participants' open-ended descriptions about the future on the extent that their projection of the future is characterized by change and progress (1 = *very low*, 4 = *moderate*, 7 = *very high*; *ICC* = .83). An independent *t*-test confirms that participants in the high change condition ($M = 5.36$, $SD = 1.09$) perceived the future with higher levels of change and progress than did those in the low change condition ($M = 2.60$, $SD = 1.61$), $t(122) = 11.13$, $p < .001$, $d = 2.01$, 95% CI_{diff} [2.27, 3.25].

4.3.2. Design task performance

A series of *t*-tests supported our hypotheses across the creativity indices of the creature design task. Thinking of a future with high rather than low levels of change promoted designs with higher novelty ($t(122) = 3.02$, $p = .003$, $d = 0.54$, 95% CI_{diff} [0.28, 1.36]), deviance ($t(122) = 2.78$, $p = .006$, $d = 0.50$, 95% CI_{diff} [0.24, 1.41]), and practicality ($t(122) = 2.26$, $p = .03$, $d = 0.41$, 95% CI_{diff} [0.07, 1.04]).

4.3.3. Mediation analyses

Next, we tested whether thinking of a future with high (vs. low) change facilitated creativity through increased accessibility of the change and progress schemas. Similar to Study 2, we found a significant mediation for the novelty and deviance dimensions, but not practicality. For brevity, the reported mediation is based on an overall creativity index obtained by averaging the standardized novelty and deviance scores. The predictor, time-orientation, was dummy-coded (1 = *future-oriented thinking with high change*, 0 = *future-oriented thinking with low change*). We also note that thinking of the future in terms of high (vs. low) change led to higher accessibility of competence ($B = 0.75$, $SE = 0.31$, $p = .018$). However, neither accessibility of competence nor the other factors predicted higher creativity (all $|B\text{'s}| < 0.04$, $p\text{'s} > .47$; see Supplementary Tables S5a and S5b). In other words, only accessibility of change and progress uniquely mediated the effect of future-oriented thinking with high (vs. low) change on creativity.

As hypothesized, in the first path, imagining the future with high (vs. low) change led to higher accessibility of change and progress ($B = 1.02$, $t = 3.59$, $p < .001$, 95% CI [0.46, 1.58]). In the second path, accessibility of change and progress predicted higher creativity ($B = 0.12$, $t = 2.48$, $p = .015$, 95% CI [0.02, 0.22]). The direct effect of manipulating high versus low levels of change on creativity remained significant ($B = 0.38$, $t = 2.40$, $p = .018$, 95% CI [0.07, 0.70]), thus indicating a partial mediation. The indirect effect ($P_M = .24$) was significant, as indicated by a bootstrapped 95% CI [0.04, 0.25] that did not bound zero.

4.3.4. Creative insight performance

No effect of the manipulation on creative insight was found on the RAT ($t(122) = -0.70$, $p = .49$) or insight problems ($t(122) = -0.91$, $p = .37$). As with earlier studies, the results suggest that the creative benefits of future-orientation are primarily observed in the design task, but not on creative insight or RAT performance.

4.4. Discussion

Study 3 supports Hypotheses 2 and 3. Importantly, it establishes the causal role of change and progress schemas in facilitating greater creativity. Thinking of a future with high (vs. low) levels of change led to more novel and deviant creature designs, mediated through greater accessibility of change and progress schemas. Overall, these findings provide robust support for our predictions that future-oriented thinking brings to the fore change and progress schemas and thereby catalyzes creative thoughts.

4.5. Meta-analytic summary of effect sizes

We want to note that the three studies reported are the only three studies we have conducted. The time-orientation manipulation and creativity measures reported were also the only manipulation and measures we used. To summarize the three studies, we conducted a fixed effect meta-analysis (Hedges & Olkin, 1985; Hedges & Vevea, 1998) to estimate an overall effect of future-oriented thinking (i.e., Studies 1 & 2: future-oriented vs. present-oriented thinking; Study 3: future-orientation with high change vs. low change) on creativity. We focused on the novelty and schema deviance indices of creativity. The estimated mean effect of future-oriented thinking on novelty is Cohen's $\overline{d} = 0.59$, with Cochran's $Q(1) = 0.96$, $p = .62$, suggesting that the effect observed across the studies are relatively homogeneous. The mean effect of future-oriented thinking on schema deviance is $\overline{d} = 0.66$; $Q(1) = 1.52$, $p = .22$. These results support that the future-oriented thinking manipulation that activates the schemas of change and progress shows a consistent medium-size effect on creative idea generations (albeit not creative insights).

For comparison purposes, we also estimate the effect of future-oriented thinking on creative insights. The estimated mean effect of future-oriented thinking on insight problem solving is Cohen's $\overline{d} = -0.19$, $Q(1) = 13.10$, $p < .001$. The estimated mean effect of future-oriented thinking on RAT scores is Cohen's $\overline{d} = 0.10$, $Q(1) = 18.35$, $p < .001$.

5. General discussion

Relying on schemas that represent conventional ideas can inhibit creativity during idea generations. In contrast, adhering less to schemas that conventionalize thinking and activating schemas that highlight change and progress through future-oriented thinking can diversify sources of ideas to boost creativity. Results from three studies are consistent with our propositions. The preliminary study and Study 1 provide evidence that future-oriented schemas are predominantly characterized by change and progress (H1). In Studies 1 and 2, future-oriented thinking caused increased creative performance (H2). Studies 2 and 3 demonstrated that the creative benefit of future-oriented thoughts was causally mediated through making change and progress schemas more accessible (H3). Across three studies, we observed robust benefits of future-orientation on creative performance in terms of producing more novel and normatively deviant ideas, but not in terms of

coming up with the correct solution to insight problems.

5.1. Theoretical contributions

The present research enriches understanding of how induction of mental frames in tandem with the activation of social schemas could influence creativity. By bridging creative cognition research with social schema research, we unravel the creativity-facilitating consequence of future-oriented schemas. First, this adds to existing knowledge on how to enhance creativity by thinking outside typical schemas. Past research demonstrated that schema-violating encounters (Ritter et al., 2012), immersive multicultural experiences (Leung et al., 2008), and exposure to counter-stereotypes (Gocłowska & Crisp, 2013) challenge one's schemas and enhance divergent thinking. We present a novel finding that activating different time-oriented schemas also impacts creativity. As shown, future-oriented thinking liberates people from fixating on present-oriented schemas, thereby fostering norm violations and expectations for change and progress to catalyze creative generations of ideas.

Second, building on the robust phenomenon of structured imagination, we examined the often-neglected *contents* of schemas that different mindsets induce. Research on creativity-facilitating mindsets has focused extensively on the *ways* people process information, such as the manner in which a promotion regulatory focus (Baas et al., 2008) or positive affective experience (Fredrickson, 2001) can broaden use of information to produce creative synthesis of ideas. Grounded on the creative cognition approach, our work contributes new knowledge by examining the contents of schemas activated by a future-oriented mindset. In so doing, we reveal a novel perspective that not all schemas are creativity-inhibiting; schemas such as those that characterize the future with change and progress could in fact be creativity-invigorating.

5.2. Bridging the benefits of future-oriented thinking to the broader creativity literature

We posit that it is theoretically fruitful to bridge the current findings about the creative advantages of future-oriented thinking to the broader creative cognition literature. For example, the construal level theory (Liberman, Trope, & Stephan, 2007; Trope & Liberman, 2010) is highly relevant to the current research. This theory postulates that mental representations of psychologically distant entities (e.g., the future, a distant place) tend to be more abstract (vs. concrete). In turn, abstract thinking could promote idea generation through loosening connections between concepts (Ward, Patterson, & Sifonis, 2004) and facilitating problem restructuring (Ash & Wiley, 2006). Several studies support this proposition showing that imagining oneself working in the future (e.g., 1–2 years later) facilitates insight problem solving (Förster, Friedman, & Liberman, 2004) and generation of integrative solutions in negotiations (De Dreu, Giacomantonio, Shalvi, & Sligte, 2009; Henderson, Trope, & Carnevale, 2006). People also exhibited more creative insight when working on tasks designed by a spatially distant institution (Jia, Hirt, & Karpen, 2009), or when generating ideas and problem solutions for socially distant others (Polman & Emich, 2011).

Nevertheless, the current findings do not fully support the level of construal account. First, Study 3's experimental manipulation of perceived levels of future change (high vs. low) rules out a pure construal level explanation. If only construal level was involved, construing both high and low levels of change in the future would still elicit a high construal representation and give rise to similar creative advantages. Therefore, it would not predict a positive effect of the manipulation inducing high (vs. low) change.[2] Second, although psychologically distant entities tend to be construed abstractly, we argue that people can also foresee the future in a concrete manner. For example, participants in the present research produced many specific projections about the future, including the over-reliance on mobile devices, minimal face-to-face human interaction, depletion of natural resources, surge of the usage of robots, and many concrete examples of advanced transportation technologies. The current findings do not seem to suggest that the observed creative advantages emerge from inducing a higher level of abstract thinking after a future construal. Rather, they support a more parsimonious account that people can become more creatively inspired if they hold schematic expectations of future change and progress, which do not necessarily put people in an abstract mode of thought.

Another line of relevant research concerns the regulatory focus orientation. Arguably, inducing thoughts about progress and advancement could also increase people's *promotion-focus* mindset, which had previously been linked to enhance creative thinking (Baas et al., 2008; Baas, De Dreu, & Nijstad, 2011; Friedman & Förster, 2001; Lam & Chiu, 2002). The regulatory focus theory (Higgins, 1997; Molden, Lee, & Higgins, 2008) posits two broad motivational orientations stemming from the basic needs for growth and advancement (i.e., a promotion-focus) and for safety and security (i.e., a prevention-focus). A promotion focus provides an impetus to pursue goals with *eagerness*, to approach positive outcomes, and to even take opportunistic risks (Zou, Scholer, & Higgins, 2014). In contrast, a prevention focus mobilizes *vigilance* to avoid negative outcomes and to maintain the status quo. As creative endeavors often entail change and uncertainty, a promotion-focus motivational state is more likely to enhance creativity than a prevention-focus motivational state (Baas et al., 2008). By extension, the theory also alludes to *regulatory fit*, a state experienced when the nature or context of the task aligns with their motivational orientation, which heightens intrinsic motivation and performance (Freitas & Higgins, 2002; Higgins, 2000, 2005). One plausible explanation for our result is that inducing a future-oriented thinking either directly induces a promotion-focus, or put promotion-focus people in a state of regulatory fit that enhances their creative thinking. However, it is difficult to fully explain our results using regulatory focus as people become more creative only in idea generation, but not creative insight. As the regulatory focus benefit on creativity is thought to be due to higher intrinsic motivation, a generalized benefit would have been expected for both idea generation and creative insight.

However, it is interesting to speculate that the link between future-oriented thinking and creativity could be moderated by both promotion and prevention regulatory focus. It is reasonable to argue that thinking of the future not only activates promotion focus thoughts about growth and progress, but also thoughts about potential problems and dysfunctions (Bain et al., 2013, 2016; Kashima et al., 2009), which may resonate with prevention focus individuals. Interestingly, existing research also showed that sometimes a prevention focus could benefit creativity, such as when goals are left unfulfilled (Baas et al., 2011). Another research found that when individuals with high levels of neuroticism feel worried, they perform more creatively than when they feel happy or calm (Leung et al., 2014). This is because individuals with higher neuroticism are motivated to avoid threats, thus the worrisome emotion serves to support their prevention motivation by mobilizing the vigilance system to manage threats, which can enhance their performance (Carver, 2001; Elliot & Thrash, 2002). Therefore, it is possible to hypothesize that regulatory focus can moderate the link between future-oriented thinking and creativity. If thinking about the future activates more thoughts about growth and progress, creativity should be particularly higher among promotion focused individuals. But if thinking about the future activates more thoughts about potential problems and dysfunctions, creativity should be particularly higher among prevention focused individuals. That is, if future-oriented thinking produces unconventional thoughts that are more motivationally relevant, this should have a greater impact on people's subsequent behavior.

[2] We would like to thank our action editor for offering us this important insight.

5.3. Limitations and future directions

Although we found robust effects of future-orientation on creative idea generations as reflected in how novel the generated designs are and how much the designs deviate from prototypical ideas, such effects did not extend to creative insights that require solving problems with a correct answer. We reckon that creative insight tasks require greater involvement of convergent thinking processes. Creativity researchers have long recognized the differential roles of divergent and convergent thinking in creativity (Guilford, 1967). In particular, whereas divergent thinking involves unusual combination and transformation of ideas to create something original or non-normative, convergent thinking emphasizes speed and accuracy to identify a single optimal solution to a clearly defined problem. In addition, convergent thinking entails an evaluation of the viability of potential solutions in relation to the known and well-defined problem context in order to search for the best possible answer (Cropley, 2006). Given that future projection immerses individuals to explore possibilities of change and progress in an unconstrained context, it is theoretically reasonable that the current research found creative advantage of future-oriented thinking on the divergent thinking process of generating "out-of-the-box" ideas, but no creative advantage on the convergent thinking process of narrowing down to a single correct answer to insight problems. While the current findings offer important insights demonstrating the effect of perceived change and progress on stimulating creative idea generations that require divergent thinking, we urge future research to systematically examine the psychological underpinnings that differentiate divergent thinking (conducive for idea generations) and convergent thinking (conducive for reaching a creative insight solution). A more nuanced understanding of the divergent and convergent thinking process will make an important contribution to the creative cognition literature.

In the present research, we measured schema accessibility by analyzing participants' free associations in the open-ended writing task and by soliciting self-report ratings of societal attributes. We acknowledge that traditional cognitive research would prefer reaction time measures of schema accessibility. Reaction time measures were not viable in the present studies as they require numerous trials for ensuring reliability. To measure the diverse range of schema contents (change and progress, warmth, competence, etc.) in the midst of other neutral items would require too many trials, causing fatigue and masking the priming manipulation. Therefore, to obtain schema accessibility of change and progress as the mediating variable, we adapted rating scales that assess people's projections of societal attributes in a given time and place (Bain et al., 2013). This approach aligns nicely with the prior research studying people's schematic perceptions about societies or the future.

To expand the current theorizing, we suggest future research to also explore the association between past-oriented thinking and creativity. Whereas people project change and progress in the future, they tend to conceive the past as traditional, simplistic, and undeveloped (Kashima et al., 2009). Although these concepts may be creativity-inhibiting, people may alternatively gain creative inspirations by juxtaposing and integrating elements of the past and present. These possibilities open novel avenues for future research.

6. Conclusion

Ultimately, the desired change and progress in the future depends on the creativity and innovation mustered in the present. We argue that thinking about the future is more than just an imaginary endeavor. Rather, it materializes creative ideations to propel the next big leap forward. Future-oriented thinking promotes the breaking of schematic mental sets and diversifies sources of creative thoughts. By bringing to the fore change and progress schemas, thinking of the future helps individuals simulate ideas that inspire creative breakthroughs and even anticipate yet-to-emerge problems and their solutions to benefit the future.

Open practice section

Open materials: the full set of verbatim materials have been attached in the online supplementary files. The methods section of the paper in combination with the materials from the online supplement will enable an independent researcher to fully reproduce the reported methodology.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jesp.2019.103816.

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