In times of illness: Covid-19 threat influences temporal focus and implicit space-time mappings

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ARTICLE INFO

ABSTRACT

According to the Temporal Focus Hypothesis, people's front-back mental space–time mappings are associated with their attention to the time frames of past and/or future. Based upon the findings that pathogen threats elicit preferences for social conservatism and traditions, we theorize that activating thinking about COVID-19, an ongoing pandemic of coronavirus disease 2019, will promote people's past-oriented thinking and increase their responses of past-in-front mapping. By manipulating saliency of coronavirus threat, our results showed that exposure to information about coronavirus created changes in a stronger past focus and caused a significant increase in the rate of past-in-front responses, which provides supporting evidence for the Temporal Focus Hypothesis. These findings suggest that the unprecedented pandemic not only harms people's health, but also can influence the way they construe the world.

1. Introduction

The current outbreak of the coronavirus disease (COVID-19) across the world has caused a sharp rise in the number of people infected (Wang et al., 2020). Although the health consequences of the COVID-19 pandemic are clear (Grossman et al., 2020; Yıldırım & Güler, 2020), sparse attention has been paid to its cognitive consequences. In the current investigation, we sought to examine whether the novel coronavirus influences people's temporal focus and implicit space-time mappings. We propose that the pandemic will increase individuals' attention to the past and enhance their tendency to conceptualize the past as in front.

Time shapes the human experience and behavior. However, human beings do not possess a single apparatus in brain that is responsible for processing temporal experience. According to Conceptual Metaphor Theory, time is an abstract idea that is constructed with multiple metaphors resulting from our concrete concepts such as space and motion (Lakoff & Johnson, 1980). Indeed, across languages and cultures, people recruit different spatial metaphors to understand and speak about time (Boroditsky, 2018; Núñez & Cooperrider, 2013). For instance, Aymara speakers in South America tend to conceptualize the future as behind, and the past as in front in their speech and gesture (Núñez & Sweetser, 2006). Yet, recent evidence has shown that though Darija speakers in

Morocco tend to map the future onto a front position and the past as behind them in their speech, they gesture adhered to the past-in-front pattern, which suggests a dissociation between temporal language and temporal thought (de la Fuente et al., 2014).

To understand possible (dis)associations between temporal language and temporal thought, scholar proposed the Temporal Focus Hypothesis (TFH), which posits that people's front-back mental space–time mappings depend on how they characteristically devote their attention to the past and/or future (de la Fuente et al., 2014). For instance, cross-cultural research has shown that Moroccans, who preserve heritage, tradition and culture, were more likely to conceptualize the past as in front than Spaniards who place importance on technological advance and economic growth (de la Fuente et al., 2014; also see Callizo-Romero et al. (2020) on 22 (sub)cultures for similar findings).

Furthermore, a wide range of sociological, contextual, and personality factors play a variety of roles in how people mentally represent temporal focus and thus their space-time mappings (Li & Cao, 2019, 2020a). For instance, reasoning that conservatives, who place a value on tradition, are characterized by their past-focused thinking, while liberals, who favor change, are characterized by their future-focused thinking, Li and Cao (2020b) predicted that conservatives and liberals would be more likely to think about time adhered to the past-in-front pattern and to the future-in-front pattern, respectively. In line with

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these predictions, they found that conservatives mapped the past as in front significantly more often than liberals, and liberals mapped the future as in front significantly more often than conservatives. Thus, these findings offered supporting evidence for the TFH.

One line of research on political and ideological orientations is the work on the consequences of pathogen prevalence (Ma, 2021; Makhanova & Shepherd, 2020). Many scholars have converged on the idea that infectious diseases would shift individuals into the more conservative end of the political spectrum (Thornhill et al., 2009). For instance, in a cross-nation study involving 11,501 participants, Tybur et al. (2016) found that national parasite stress was positively related to traditional norms and conservatism. Several viable hypotheses have been proposed to explain why pathogen threats are correlated with political conservatism and endorsements of traditional rules and rituals. These include restricted sex (reducing sexually transmitted infections), traditional food preparation techniques (ingredients containing antimicrobial activity against bacteria), and traditional hygiene rules (washing hands properly before dressing a wound). These findings were confirmed in a systematic review and meta-analysis by Terrizzi Jr et al. (2013). Their findings indicated that the behavioral immune system designed to promote the avoidance of infectious disease is positively associated with many aspects of social conservatism including right-wing authoritarianism and political conservatism. One additional line of research suggests that liberalization of social values in Europe corresponds with decreased opportunities for the transmission of infectious disease because of technological advancement and that liberal ideologies are more frequent in areas that are relatively low in parasite-stress (Thornhill et al., 2009). Thus, this literature provides converging evidence that when threatened by pathogens, people may demonstrate a greater average past time perspective.

Integrating two separate streams of research—namely, investigating political consequences of parasite stress in social and personality psychology and research investigating the association between temporal focus and implicit space-time mappings in cognitive psychology—an essential next step of this inquiry is to examine whether the unprecedented pandemic will impact people's spatial conceptions of time. Based on the solid theoretical background, along with multiple studies providing empirical evidence that pathogen can increase preferences for social conventions and traditions, we propose that activating thinking about coronavirus will promote people's past-oriented thinking and increase their responses of past-in-front mapping.

2. Method

2.1. Participants

Participants were recruited through a Chinese social media platform Wechat and were tested individually in Sichuan province, southwest China. There were no confirmed cases in this area or no new confirmed cases for 14 consecutive days during the experimental session. Participants arrived at the meeting point according to the appointment time allocated to them before the experiment. A total of 210 adults (46% women; age range: 18–60, $M = 38.2$, $SD = 11.4$) took part in the study for a monetary reward (20 RMB yuan). All of them were native speakers of Mandarin and of Han ethnicity. To reduce opportunistic use of Research Degrees of Freedom in research, we did not conduct any statistical analysis of the data until all data collection was completed, and no participants were added following the first analyses.

2.2. Materials and procedure

This study consisted of two ostensibly unrelated parts. In the first part of the study, participants were randomly assigned to one of two conditions and were presented with two newspaper articles (approximately 300 words each). In the control condition, there were two newspaper articles (sports news). In the experimental condition, there were one newspaper article (sports news) and one newspaper article about the COVID-19 pandemic. These press reports are neutral in terms of temporality. For instance, the sport news is about the balance between athletes and commercial rights and the news on the global pandemic is about disease basics, prevention, and treatment. The order in which the participants read the articles was fully counterbalanced in the two conditions. They were instructed to answer three questions on the quality of the materials (i.e. the article is interesting and riveting; the article contains understandable language; the article addresses social problems), using a five-point Likert scale (ranging from $1 = I$ *totally disagree*, to $5 = I$ *totally agree*). Two single-choice questions (e.g., The first/s press report is about?) regarding the content of each newspaper articles served as an attention check to confirm that participants read the reports carefully. As manipulation check, participants reported how they thought about the influence of the COVID-19 ($1 = not\ at\ all$, $5 = very\ severe$).

In the second part of the study, participants were first asked to complete the time diagram task, which was used to measure the direction of implicit space-time mappings in many published studies (de la Fuente et al., 2014; Li & Cao, 2019). Participants saw a cartoon character in the center of the questionnaire sheet between two empty boxes, one ahead of the character and the other behind him (see Fig. 1). They read that the character, named Li Hua in the Chinese version, went to visit a friend who likes plants yesterday and would be going to visit another friend who likes animals tomorrow (or vice versa, as plants and animals were counterbalanced between yesterday and tomorrow). Participants were asked to assign plants and animals, which represent the conceptions of past and future events respectively, into boxes in front and back of the character. The order in which participants were asked to locate the plant and animal was counterbalanced, to ensure that any associations between space and time were not confounded with numerical or temporal order.

After finishing the temporal diagram task, participants were asked to respond to a Chinese adaption based on the English version of the Temporal Focus Scale (Li & Cao, 2019; Shipp et al., 2009). It consists of 8 items: 4 measuring past-focused thinking ($\alpha = 0.84$ for the control group and $\alpha = 0.86$ for the experimental group) and 4 measuring future-focused thinking ($\alpha = 0.84$ for the control group and $\alpha = 0.89$ for the experimental group). Participants were required to rate each item on a 7-point Likert scale ($1 = never$; $3 = sometimes$; $5 = frequently$; $7 = constantly$).

2.3. Results

No participants failed the attention check question and expressed skepticism regarding the link between the reading task and the time diagram task. Participants in the experimental condition reported that they were more affected by the COVID-19 ($M = 3.87$, $SD = 1.00$) than those in the neutral condition ($M = 3.21$, $SD = 1.44$), $t(208) = 3.84$, $p < .001$, $d = 0.53$. Thus, the manipulation was indeed successful.

In line with our predictions, the sagittal space-time mappings significantly differed between the experimental and control groups ($p = .001$ by Fisher's exact test). The majority of participants (63.8%) in the experimental condition responded according to the past-in-front mapping, placing the entity representing the past in front of the character ($Z = 2.83$, $p = .005$ by Sign test). However, participants in the control condition showed no significant difference in preference between past-in-front mapping (42%) and future-in-front mapping (58%) ($Z = 1.66$, $p = .10$ by Sign test).

We conducted a two-way mixed model ANOVA to analyze the responses to the TFS, with one between-subjects factor (Group: past-in-front vs. future-in-front) and one within-subjects factor (Temporal Focus: past vs. future). The dependent variable is the average agreement with the past- and future-related statements. As predicted, we observed a statistically significant interaction between Group and Temporal Focus, $F(1, 208) = 11.33$, $p = .001$, $\eta_p^2 = 0.052$. Tukey-type all-pairs
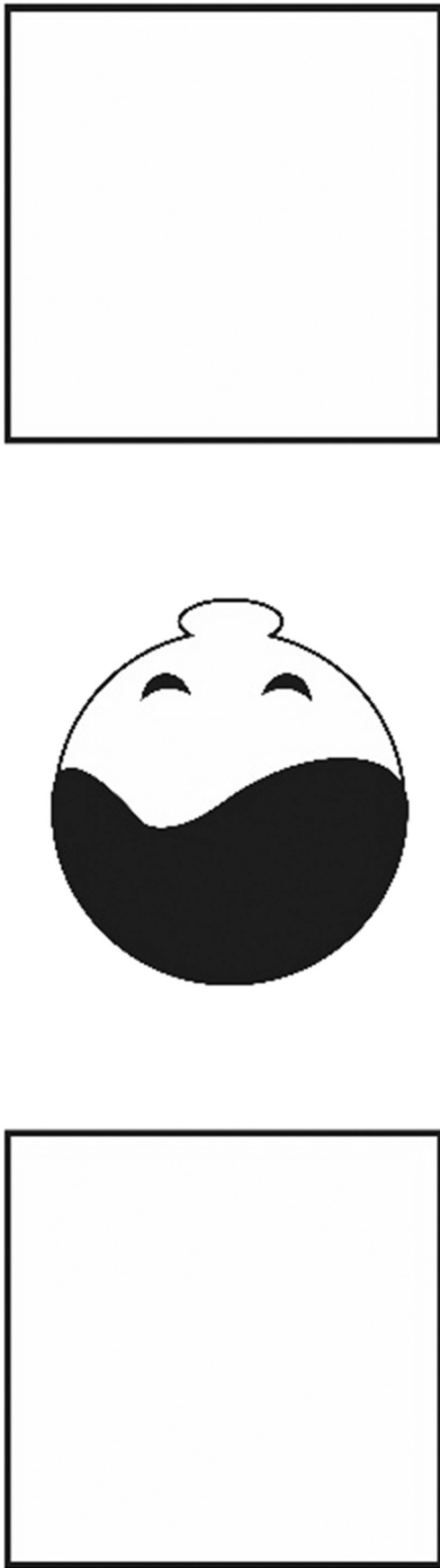
Fig. 1. The time diagram presented to the participants.

comparisons revealed that participants in the experimental condition showed stronger agreement with past-focused statements ($M = 4.82$, $SD = 1.09$) than those in the control condition ($M = 4.32$, $SD = 1.24$), $p = .002$, and participants in the control condition showed slightly stronger agreement with future-focused statements ($M = 4.52$, $SD = 1.27$) than those in the experimental condition ($M = 4.18$, $SD = 1.46$), $p = .073$.

3. Discussion

In the current investigation, we obtained evidence for a change in temporal focus and in implicit space-time mappings threatened by the coronavirus pandemic. By manipulating saliency of the COVID-19, we demonstrated that activating thinking about coronavirus increased people's attention to the past and promoted their responses of past-in-front mapping. These findings converge with an emerging literature that people's implicit space-time mappings depend on their temporal focus, supporting the TFH.

This study offers several notable theoretical contributions. First, the present research revealed that large scales of infectious disease, an un-explored factor, influences people's spatial representations of time. We also identified one mechanism that explains the causal effect of the unprecedented pandemic on time cognition: exposure to cues of coro-navirus created changes in a stronger past focus, which may in turn increased the tendency to produce the past-in-front mapping. The social psychology literature suggests that national parasite stress is strongly associated with traditionalism (Tybur et al., 2016). For example, norm violating behaviors may put individuals at an increased risk for infec-tion, so more pathogen-avoidant individuals demonstrate a greater preference for ideological positions that encourage compliance with traditional norms (Schaller & Murray, 2008). According to the TFH, time spatialization depends on the balance of attention devoted to thinking about the past (tradition) and the future (progress)(Callizo-Romero et al., 2020). Since parasite stress can elevate traditionalism, this may cause individuals to focus their attention on past events and thus a greater proportion of past-in-front mapping. Such mechanism awaits future exploration.

This pattern of results also coheres with previous findings that temporal focus shifts following significant events. For example, Holman et al. (2016) found that the September 11th terrorist attacks induced a greater past time perspective that even persisted a year-later. Our research thus contributes to the literature on how momentary attention can be directed to a time frame based on a specific cue (i.e., reading information about pandemic) despite the stable aspect of temporal focus (Shipp & Aeon, 2019).

Second, our findings contribute to the scientific debate on the replicability of temporal induction priming technique in research on implicit space-time mappings. In de la Fuente et al.'s (2014: Experiment 5) Temporal Induction Task, Spanish participants were randomly assigned to write down answers to direct their attention to the past or future. The results showed that whereas participants tended to conceive the past as in front under the past-focus induction condition, they tended to conceive the future as in front under the future-focus induction con-dition. However, using the same technique, Bylund et al. (2020) failed to replicate these findings in British and Swiss French participants. Based on these results, they proposed that the attested space-time mappings in people's minds were unlikely to be affected by short-term shifts in temporal focus. Our results indicated that rapidly induced temporal focus changes by manipulating saliency of the COVID-19 can sufficiently alter time spatialization, which demonstrates the high malleability of time representations. Meanwhile, although the effect of pathogen threat on implicit space-time mappings was significant, the effect size was likely to be small. This is not surprising since people's front-back mental space–time mappings are shaped by a complex of factors (Callizo-Romero et al., 2020).

However, it should be noted that the priming technique in our experiment is different from the Temporal Induction Task in prior

studies. This points to a potential limitation of our research. It may be the case that the effect can only be observed in Mandarin speakers, who showed no clear preference for past- or future-in-front mapping in the neutral context as shown in our control group. Thus, it is important to investigate the generalizability of current findings across different cultural groups.

Connecting the fields of social psychology, cognitive psychology and environmental studies, our results have uncovered one cognitive consequence of the unprecedented pandemic. The present findings have several implications. For one, it suggests that people have become more nostalgia in times of chaos. From an evolutionary perspective, thinking about good old days and conceptualizing the past as in front may help individuals better get through the crisis. More broadly, it provides a more complete scholarly understanding of the factors that may affect mental associations between space and time.

CRediT authorship contribution statement

Heng Li: Conceptualized the study, developed the methodology, generated the writing, original draft, revising, review, and editing.
Yu Cao: Data curation and validation.

Acknowledgments

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