TIME CONCEPTUALIZATION ACROSS CULTURES AND RELIGIONS

Adviser Julio Santiago **Ph. D. Candidate** Carmen Callizo Romero





UNIVERSIDAD

DE GRANADA

DOCTORAL THESIS

Doctoral Program in Psychology

International Doctorate

TIME CONCEPTUALIZATION ACROSS CULTURES AND RELIGIONS

Ph.D. Candidate

Carmen Callizo-Romero

Adviser

Julio Santiago

Departamento de Psicología Experimental

Centro de Investigación Mente, Cerebro y Comportamiento

December 2022

Editor: Universidad de Granada. Tesis Doctorales Autor: Carmen María Callizo Romero ISBN: 978-84-1117-711-5 URI: https://hdl.handle.net/10481/80350

The research contained in this international doctoral dissertation was funded by a research contract from the Spanish Ministry of Economy and Competitiveness (reference: BES-2016-076717) and by a grant from the Fulbright Commission (reference: PS00326707).





The images appearing in this dissertation (on the front cover, back cover and accompanying each section) have been generated using Artificial Intelligence (Stability, Midjourney, and VQGAN+CLIP neural networks text-to-image softwares). I would like to express my gratitude to the people (loved ones) who have collaborated with me in the creation and selection of such images.

A aquella persona cuyo amor hacia mí es, en pasado y futuro, siempre presente. A mi madre.

AGRADECIMIENTOS

Me encuentro ante la puerta del tiempo, frente una tesis recién finalizada y echando la vista hacia el pasado, sintiendo cómo ha sido la andadura en los últimos años para llegar hasta este momento. Al hacerlo se sitúa ante mis ojos la presencia de tantas personas sin las cuales no podría encontrarme hoy aquí. Y es que éste ha sido, sin duda, un viaje compartido. Por ello, quiero dar las gracias.

En primer lugar quisiera expresar mi agradecimiento a mi familia, por ser la razón primera de que pueda escribir estas líneas, por darme referentes que aplicar a todo aquello a lo que dedique mis energías, por apoyarme siempre.

Gracias a mis padres, por darme la vida. Por ofrecerme una composición muy particular y totalmente enriquecedora de valores y disposiciones ante el mundo. Por el cariño y la perseverancia.

Mamá, gracias por tu siempre estar. Por tus cuidados inagotables. Por acompañarme cada día de mi vida con toda tu fuerza y cariño. Por darme lo más puro que se le podría ofrecer a cualquier persona: amor incondicional. Un amor me que me acompaña otorgándome fuerza y paz ante toda situación posible. Ese ha sido siempre tu regalo hacia mí. Para ti va dedicada esta tesis, pues te lo debo todo.

Gracias a mis hermanos. A Antonio por acompañarme a lo largo del doctorado allá donde fuese a investigar, sin importar la distancia. Por hacerme ver que el mundo no tiene límites cuando se trata de hacer las cosas que más quieres. Gracias a Rosario y Alejandra, por ser mi mayor inspiración. Por la confianza y unión con la que hemos atravesado tantas cosas estos años. Por darme tanta luz cada día, no solo para escribir esta tesis, sino para vivir.

A mis primos y primas. Quisiera resaltar el agradecimiento a Teresa, por recorrer el mundo para visitarme en mi andadura doctoral y así extender los lazos familiares al otro lado del Charco ¡Era posible! Por la inocencia con la que vives, tan iluminadora para mí. A Alex por bajar lo decibelios de una familia alborotada. Gracias a Miguel, por tu resplandeciente bondad. A Juanma y Sara por vuestra combinación de corazón y diligencia. A Óscar, por darme el motivo por el que salir a jugar tantas veces cuando había sobrepasado, por mucho, el límite de horas que debía dedicar a escribir este trabajo — gracias a Bimba también por este mismo sentir. Porque verte crecer estos años, Óscar, ha sido una de mis mayores pasiones.

A mis tías y tíos y familiares tan queridos. Entre ellos especiales gracias a mi tía Pilar, por hacer de madrina conmigo desde que nací. También, por hacer posible que, verano tras verano, esta tesis haya podido ser escrita frente al mar. Cuánta inspiración de este trabajo debo a tu generosa ofrenda. A mi tía Carmen María, por preguntar y acompañar. A mi tía Carmen Callizo, tocaya de nombre, apellido... y mucho más. Me siento muy agradecida de haber podido descubrirte — después de tanto tiempo — durante estos años doctorales. A mi tío Luis, porque siento cada día todo el apoyo que diste cuando comencé la tesis, aunque ya no puedas decírmelo. A mi tía Ana, por ser portadora de fuerza y determinación. A Alicia también por tu fuerza, y por tu valentía. A Mati, por purificar siempre nuestro hogar, mucho más allá de la limpieza.

A mis abuelos, por haberme dado la referencia de origen, a la que vuelvo cada día. Porque os veo reflejados y me enseñáis a través de tantas personas que quiero. A mi abuela Rosario, por tu alegría y desparpajo. A mi abuela Carmina, por ser un enorme ejemplo de bondad y sensatez. Siempre lo vas a ser para mí. Por haberme acogido y dado un hogar tan maravilloso. Por trasmitirme tus cuidados ante la vida. Porque no tengo palabras para agradecer la inmensa fortuna que siento al poder de verte cada día mientras esta tesis termina de ser escrita.

Dicen que los amigos y las personas que se van incorporando a tu vida a lo largo del camino son la familia que se elige. La verdad es que yo esto lo concibo más como un regalo que como una elección, y como tal, solo puedo expresar mi gratitud. Gracias a aquellos que aún sin estar en el contexto del doctorado, me han acompañado tanto durante esta etapa.

Gracias, primero, a las personas que me acompañan en este camino de manera tan generosa. A Sara, por ser un lugar donde poder mostrarme con total apertura. Por tu apoyo incesante. Por ofrecer claridad a mi mente y mi corazón. Por la ilusión y la sensibilidad con la que te diriges al mundo y tramites a todo aquel que se acerca a ti. Gracias Patama, por ilustrar esta tesis —en el sentido más literal— y mucho más allá de eso, mi existencia en general. Por poder encontrar en ti formas de vivir que me resultan tan diferentes a las mías y tan enriquecedoras. Por el aprendizaje continuo. A Mariajo, por aparecer cada día a las 00:00 horas recordándome así el

regalo de tu presencia en mi vida. A Alex, por largos paseos junto al mar en los que poder mostrarnos de forma transparente — ¡A veces el único descanso que me permitía darle a este trabajo de investigación! — A Belén, por conectarme con lo que trasciende y dejarme ver cómo esto se refleja en tu estar en el mundo. A Borja, por ser fuente de inspiración y de bondad. Por hacerme sentir que un cambio de paradigma se puede afrontar de manera tan amorosa.

Gracias a los que me dan sentido de hogar. A Mar, Cabre, Sory, Carolina, Lorena, Paloma, Blanca... por haberme hecho sentir que sigo teniendo en Murcia mi lugar, por muy lejos y por mucho tiempo que pudiera marcharme para investigar y para descubrir más allá. Gracias especiales a Pilar, por darme un sentido tan claro de realidad. A Marta, por tu sensible entereza. Gracias a los amigos que he encontrado precisamente cuando he ido a investigar más allá. Thanks to Irena for being such a nice person, and for having welcomed me in your home in Bosnia-Herzegovina. To Dave, Kate, Kaitlyn, John... for your hospitality in Boston. To Cristina, Miguel, Pol, Pau, Santi, Diego, Ignacia, Ashly, Alejandro, Abraham, Emmanuela, Parsa, Marco Antonio, Pilar, Karim, Alexandru, Isaac, Enes... for being my family in Santa Barbara. A Rosa por haberme dado cobijo murciano en San Diego.

Gracias a las personas que desde la buena amistad habéis inspirado tanto mi investigación. Gracias a Rafa por compartir ideas y proyectos, y sobre todo, por tu calidez humana. ¡Quién iba a pensar la tierra emiratí podía ser tan fértil! También por esto a ti, Juan, y por tu interés tan genuino en mi investigación. A Vicente, por ser ejemplo de cómo actuar en el mundo académico y mucho más allá. Ah, claro, y por ofrecerme tanto *affordance*. A Fran, por sacar la filósofa que hay en mí. A Pablo por hacerme mirar más allá en lo que investigo motivándome a buscar el significado y el verdadero sentido. A Marian, Paco y Carmen, por iluminarme oscuros lugares del saber. A Paco por enseñarme, desde el principio y con tanta honestidad, que las ideas han de ir de la mano de la amistad.

Gracias a aquellas personas que han tenido un papel más directo en esta tesis, que me han acompañado en la investigación, que han supervisado mi trabajo e intercambiado ideas de forma tan enriquecedora. Este trabajo es también vuestro.

En primer lugar, todo mi agradecimiento a ti, Julio, por haberme ofrecido la oportunidad de crear esta tesis de forma conjunta. Por haber confiado, desde el

primer momento, en una filósofa con cientos de cosas que aprender sobre psicología experimental pero, también, tan llena de motivación (como sabes, aunque la motivación ya era alta, ¡no ha hecho más que incrementar hasta el día de hoy!). Por haberme permitido reflexionar desde el mundo de las ideas al tiempo que me bajabas, una y otra vez, a la realidad. Por haber estado siempre ahí, respondiendo y compartiendo tu conocimiento y experiencia. Por mostrarme tu comprensión en los momentos difíciles y por abrirme las puertas de tu casa — aquí quisiera agradecerte a ti también, Ana, tu calurosa acogida. Ojalá que este sea solo el inicio de muchos años de colaboración y amistad.

A big thank you to the co-authors of the papers presented in this thesis, for being my research family and an amazing team. Thank you for sharing your knowledge from all over the world. Thanks, Alex, for exchanging so many emails full of effervescent ideas. To Tilbe, for always being there. To Yan, for the dedication you bring to what you do. To Daniel, for many eloquent and clarifying explanations. To Maja and Sladjana, for your availability from distance. Gracias a Sobh, por sentir que has estado aquí todo estos años, incluso sin habernos visto. Especiales gracias a Marc, por tu inabarcable generosidad, por llevar calidez humana al mundo académico. My heartfelt thanks to Slavica, for having given me confidence in myself to walk this path, for your warm welcome in Bosnia-Herzegovina, for transmitting so much love from serenity.

Thanks to the researchers who have supervised my work in the United States. I would like to give special thanks to Wesley Wildman, for having offered me so much more than I can express here. For you welcome and also for the brilliance and humility you represent. Many thanks to Ann Taves, for agreeing to supervise my work so generously, even when the circumstances were not the most suitable. Thank you also for deeply inspiring my research.

En este camino he tenido la fortuna de encontrarme con personas con las que he compartido todas las caras de la vivencia de hacer una tesis, especialmente —y afortunadamente— las más humanas.

Gracias a unos formidables compañeros de grupo de investigación. Aquí tengo que comenzar dando las gracias Omar, aunque me resulta una tarea difícil, pues toda palabra se queda corta para expresar gratitud ante él. Omar, superas con creces el mejor ideal que cualquier persona pudiera hacerse de un compañero y de un amigo,

gracias por estar siempre disponible desde la total generosidad. Gracias también a Pablo, por tantas ideas compartidas, ojalá que durante muchos años. A Celia por ser tan única y mostrar así a los demás que también pueden serlo. A Alessia y Laura, por la humanidad italiana traída a la investigación. A Isi, por desearme, de corazón, al inicio de esta andadura que me acompañase la Fuerza (lo ha hecho, ¡y de qué manera!). A Yamuna, porque desde que nos vimos no nos hemos separado, por muchos kilómetros que haya entre nosotras. Por acogerme siempre.

Gracias a los seres que acompañan el viaje de manera tan especial. A Isma, por tu extraordinaria nobleza. Por dirigirte siempre desde el corazón. A Klara, por arrojar tanta delicadeza y profundidad, por mostrarte a mí desde ahí en tantas ocasiones. A Greta, por enseñar cada día que la vida es mucho más fácil y divertida de lo que se podría imaginar. A Belén, por recordarme activar el filtro de inocencia en la mirada a la hora de descubrir el mundo. A Rafa, por encarnar una maravillosa combinación de sensibilidad y madurez que enseña a cada paso. María C., por tu transparencia, por tu claridad, por tu humanitaria intrepidez... por lo que me enseñas con todo esto.

Gracias a María F., por tu enorme fortaleza, tu enorme sensibilidad. Por tu estar tan generoso. A Juan Eloy, por tu increíble templanza solo alterada ante dúos inverosímiles. A Cris, por la mano que me ofreciste, por el lugar amoroso desde el que pudiste hacerlo. A Josu, por compartir tantas veces tu pantalla con nosotros para experimentar juntos miles de emociones. A Jorge, por que unos tan reducidos intercambios me han bastado para aprender tanto de ti. A Shawn, gracias de corazón por conectarme con las cosas esenciales.

A Ana Paqui, por confianza Nobel en momentos de inquietud. A Nuria, por tantos años acompañándonos en los pasos paralelos de la tesis. A ti y a Gabri, por vuestra firme determinación. A Tao, por mostrar con tu tan improbable y genuina existencia, que puedes ser y tener aquello que sientas, incluso, ¡un dinosaurio! A Marta, porque lo mejor de Chicago no fue un congreso ni descubrir la ciudad, sino a ti. A Jani, por mostrar que el doctorado es importante, y la vida aún más. A Conchi, por transmitir siempre serenidad. A Chema, porque enseñas cada vez que actúas. A Marta, por tu atención plena, por tu escucha apaciguada. Giorgia, por la naturalidad que personificas ofreciendo, así, tantas posibilidades. Gracias las personas que realizan su propio viaje, por haberme ofrecido tanto en los momentos puntuales en los que trayectos han convergido: gracias Ana, Fer, Dani, Mar, Paloma, Javi, Alberto, Carlos, Enzo, Eli, Fabiano... También a Juan, María Jesús, Pedro... Especiales gracias a Cándida por ofrecerme, desde la confianza, un lienzo en blanco desde el cual que enseñar.

Gracias a las personas tan queridas que me recibieron con los brazos abiertos al llegar y que han permanecido a mi lado hasta el día de hoy. A Itsaso, por haber sido mi primer referente en la investigación y haber obtenido de ti semejante impronta. Por ser ejemplo para mí no solo en esto sino que en muchas más áreas, siempre en el marco de la búsqueda de un mundo mejor. A María, por ofrecerme, con tantísimo cariño y dedicación, un sentido de estructura. Por ser mi compañera de piso ideal. Por velar por mi bien. A Maïka, por reconectarme con mi propia serenidad con tu sola presencia. Por confiar incluso cuando los acontecimientos pudieran resultar incomprensibles. Por seguir tan cerca. Por ser una persona tan luminosa para mi vida.

Para finalizar quisiera mostrarte mi total agradecimiento, Luis, por haber querido compartir conmigo cada recoveco de este camino independientemente de si tocaban terrenos más apacibles o arduos. Por ensalzar a la honestidad como horizonte del compartir y por recordar, a cada paso, que lo importante es el *cómo* y no el *qué*. Gracias por haberme iluminado tantas veces durante la travesía; por hacerme ser, de esta manera, mejor investigadora y, mucho más allá de esto, mejor persona. Y, sobre todo, por confiar en que podamos mirar, con tamaña ternura, a pasado, presente y futuro.

A todos, gracias por haber hecho posible uno de los viajes más emocionantes de mi vida.

TABLE OF CONTENTS

ABSTRACTS	19
Abstract	21
Resumen	27
CHAPTER I: INTRODUCTION	35
The Janus god and the human conceptualization of time	37
The supremacy of the future	40
Heading to the future	40
Culturally oriented to progress	44
What if the past had supremacy?	46
There are many ways to conceptualize time across cultures.	46
Culturally oriented to tradition	48
Social crises, religiosity, and temporal focus	51
CHAPTER II: OVERVIEW OF AIMS AND RESEARCH	55
Defining variables	57
Comparing cultures and religions	64
Research goals	67
CHAPTER III: STUDY I	71
Abstract	75
Introduction	76
Methods	81
Results	86
General discussion	92
Acknowledgements and funding	96
Supplementary information	98
CHAPTER IV: STUDY II	103
Abstract	107
Introduction	108
Study 1	111
Study 2	125
General Discussion	130
Acknowledgements and funding	136
Supplementary information	137
CHAPTER V: STUDY III	161
Abstract	164
Introduction	165

Methods	169
Results	178
General discussion	193
Acknowledgments and funding	199
Supplementary materials	200
CHAPTER VI: STUDY 4	211
Personal temporal focus and time spatialization	215
Temporal asymmetries during the pandemic	218
The dissociation of the two temporal foci and their relation to religiosity	222
CHAPTER VII: STUDY 5	225
Before the pandemic	229
During the pandemic	237
General discussion	241
CHAPTER VIII: STUDY 6	245
Comparing Christians and Muslims across cultures	250
Comparing Bosniaks, Croats, and Serbs from Bosnia-Herzegovina	252
General discussion	253
CHAPTER IX: GENERAL DISCUSSION	255
Summary of findings	257
The findings in context	262
The perceived asymmetry between the past and the future	262
The perceived global magnitude	265
Reinterpreting the Janus figure in light of the dissertation findings	265
Concluding remarks	267
REFERENCES	271

Abstract

In the present doctoral dissertation we examined, through six empirical studies, how people from different cultures (American, Spanish, Serbian, Bosniak, Croatian, Moroccan, Turkish, and Chinese) and religions or religious attitudes (mainly Christian, Muslim, and non-believers) think about time. In particular, we studied the role of temporal focus (i.e., attention paid to the past versus the future) and religiosity —factors that vary cross-culturally— on five dimensions of temporal thought: where we place the past and future, whether in front or behind (spatialization); the distance we perceive to past and future events; the similarity of our current self to our past- and future- self (self-continuity); the economic valuation of past and future events (discounting); and how far we place the horizon when contemplating the past and future (depth).

Most of our studies (Studies 1-4) examined the role of temporal focus and religiosity on the perceived *asymmetry* between past and future in the five indicated temporal dimensions. We conducted this task in order to assess whether or not the metaphor ATTENDING IS SEEING plays a role in temporal thought, according to Conceptual Metaphor Theory. In addition, we showed a study in progress (Study 5) devoted to examine a complementary research topic: the role of temporal focus and religiosity on the *global magnitude* of responses in such selected temporal dimensions, for which we relied on the Uncertainty Hypothesis. Finally, after comparing people from different cultures in the previous five studies, we used our data to examine the role of religion itself on all the temporal dimensions selected (Study 6). Findings related to these topics are described below.

The first and main topic addressed was the study of perceived asymmetry with respect to the past and future, in order to examine some of the conceptual metaphors by which we think about time. The Conceptual Metaphor Theory proposes that in order to think about abstract concepts, such as time, we use concrete concepts, such as space (thus, we think according to conceptual metaphors such as TIME IS SPACE). This association may arise from the experience we have when we move forward, since, as we move, events that we will experience in the future are in front of us, while past events are behind us. This implies that we place the future in front of us and the past behind us, which is an asymmetry in time spatialization.

The bodily experience of walking forward may also cause us to perceive a future asymmetry in temporal distance (since as we move forward, the distance to the future is compressed and widens with respect to the past), implying a negative relationship between the perception of the past and the future. This, in turn, could affect the asymmetry toward the future in the other temporal dimensions studied (by feeling more similar to our future self than to our past self, discounting future rewards less than past ones, and having longer time horizons toward the future than toward the past). Given that all people walk forward, it is reasonable to think that these patterns of temporal asymmetry toward the future, born of the conceptual metaphor TIME IS SPACE, are universal.

However, we can think about time on the basis of other conceptual metaphors, such as ATTENDING IS SEEING, which would allow the existence of asymmetries towards the past. According to this conceptual metaphor, we place in front of our eyes what we pay attention to. The Temporal Focus Hypothesis applies this metaphor to temporal thought and proposes that if we give more importance to the future, we will place the future in front of us, while if we give more importance to the past we will place the past in front of us. Following this proposal, people who give more importance to the future that is also expected from the conceptual metaphor TIME IS SPACE. However, people who place more importance on the past will have an asymmetry toward the past in spatialization, distance, self-continuity, discounting, and temporal depth. The main objective of this thesis was to assess whether the metaphor ATTENDING IS SEEING plays a role in temporal thought, for which we evaluated people from cultures that vary widely in their temporal focus, looking for variations in asymmetry in the selected temporal dimensions.

The attention paid to the past versus the future (the temporal focus) can be defined in terms of the balance of attention paid to past versus future cultural values (i.e., a culture may give more importance to values related to future and progress —which are more secular— or to values related to past and tradition —which are more religious). This type of temporal focus based on cultural values was called *value temporal focus* and is the main factor considered in this dissertation. The temporal focus of values may not only vary across cultures, but also during social crises (such as the one that occurred during the COVID-19 pandemic) along with religiosity, due to the religious versus secular coping strategies that people develop to deal with such crises. In addition, in previous literature we found another conception of temporal focus referring to the attention paid to

past versus future personal experiences (i.e., to our own autobiographical past or future), which we named *personal temporal focus*. A collateral aim of this thesis was to assess whether or not both definitions of temporal focus measure the same underlying construct, using both as predictors of temporal thought.

So, we studied the role of both temporal focus and religiosity on perceived asymmetry in five temporal dimensions (spatialization, distance, self-continuity and discounting, and temporal depth), as well as their variation during the pandemic social crisis, and found that:

- Both value and personal temporal focus varied across cultures. In addition, the sample collected during the pandemic showed a greater temporal focus on progress (future), lower religiosity, and a similar personal temporal focus as matched participants collected during the pandemic (Studies 1-5).
- 2. As proposed by the Temporal Focus Hypothesis, value temporal focus predicted time spatialization: people from traditional value-oriented cultures had a greater tendency to place the past in front of themselves than people from progress-oriented cultures (Study 1). Moreover, the intensification of future values during the pandemic was accompanied by a greater tendency to place the future in front (Study 2). In contrast, we found no effect of personal temporal focus on time spatialization.
- 3. Value temporal focus played a role on the perceived asymmetry in another of the temporal dimensions studied: time discounting, such that the greater the importance given to progressive (vs. traditional) values, the greater the tendency to choose a greater reward in the future than in the past (Study 3). Moreover, the intensification of future values during the pandemic was accompanied by a greater tendency to choose a higher reward in the future than in the past (Study 4). However, neither value or personal temporal focus had an effect on any other temporal asymmetry (we found a pattern of general asymmetry toward the future in self-continuity and temporal depth; and a pattern of temporal symmetry in time distance).

Many of the findings shown supported the proposition that people think about time according to the metaphor ATTENDING IS SEEING (which is not incompatible with also using the metaphor TIME IS SPACE, depending on the context and task): although

the general asymmetry in the various dimensions is towards the future, this tendency can be modulated and even reversed due to the value temporal focus, which varies across cultures and during social crises.

However, we also found evidence against the predictions of both ways of thinking about time. First, contrary to what was expected from the TIME IS SPACE metaphor, all tasks showed a clear positive correlation between the magnitude of responses toward the future and toward the past: people who perceived more distance to an event in the future, also perceived more distance to a past event located at the same objective distance; those who discounted future events more, also discounted past events equally; etc. Second, contrary to expectations from both metaphors, there was no asymmetry in time distance. In addition, the different measures of temporal thought did not correlate with each other, showing that thinking about time is multidimensional and that it is not possible to understand it from a single underlying factor. All in all, our results suggested some degree of adequacy of the starting theoretical approaches, but also the need for future theoretical developments.

Collaterally to previous findings, we found that both measures of temporal focus were dissociated to each other and related in opposite directions with religiosity: the greater the religiosity, the less attention to past values and the greater the attention to the personal future. We considered that these pattern could be understood from the Uncertainty Hypothesis, which proposes that people from more insecure economic environments are more religious than those from secure environments. In an exploratory analysis, we found that the countries with the most religious and traditional cultures in our sample, and who think more about their personal future, do indeed have weaker and more unstable economies (as measured by GDP per capita for each country) than the cultures in the opposite group. Probably, the instability of the environment they inhabit induces a search for stability, which leads them to be more traditional and religious, as well as to focus on their personal future rather than their past.

Once the issue of temporal asymmetry was developed, we addressed a second research topic (which is in the process of elaboration): the role of temporal focus and religiosity on the perceived *global magnitude* in the selected temporal dimensions (Study 5). While in the study of temporal *asymmetries* we attended to the difference in magnitude between the responses given in the different tasks to past versus future items, in this case we focused on the overall magnitude of the responses. We expected, in the framework of

the Uncertainty Hypothesis, differences between people from cultures with more unstable economies (who are more religious, more oriented to past values, and more focused on their personal future) and those with more stable economies. The instability of the environment hinders the ability to make predictions, which may increase perceived temporal distance and decrease self-continuity. Along with the more immediate need for money, unpredictability may increase time discounting. In addition, the search for stability that increases religiosity and traditionalism may also lead them to think with more distant time horizons.

Our results found no differences between cultural groups with more versus less stable economies in time distance and self-continuity, but did support predictions regarding time discounting and temporal depth. Next, we examined whether the arrival of the pandemic could affect the perceived magnitude is these dimensions. We predicted that the observed increase in future values and decrease in religiosity during the pandemic (referenced above) would be accompanied by a decrease in time discounting and horizons, which we corroborated, although only in the cultural group with the most stable economy. We believe that the pandemic did not affect the more economically unstable cultures in these dimensions since they were already starting from a high degree of instability. Moreover, we observed an additional finding that we do not relate to the fact of being or not being in an economically uncertain context: an overall increase in the perception of temporal distance (a one-month interval was perceived as more distant than before) during the pandemic in both cultural groups, consistent with a slower passage of time during confinement.

Finally, having studied cultural variation in asymmetry and perceived global magnitude in time spatialization, distance, self-continuity, discounting, and depth, we explored the possible interreligious variation in all these dimensions (Study 6). Given that religion is an essential factor of culture with the capacity to modulate people's cognition, we thought it might affect temporal dimensions, although we had no prior hypotheses in either direction. However, our results showed that religion itself (when comparing Christians and Muslims) did not play any relevant role in any measure, neither in the perception of asymmetry nor of global magnitude. Further research with other religions is needed to clarify this question.

The dissertation concludes by discussing the findings in relation to the theoretical framework from which they are derived and concludes that: 1) we think about time

according to a set of conceptual metaphors that can make us think asymmetrically towards the past and towards the future; 2) environmental factors such as the arrival of social crises or the economic instability of the country can modulate temporal focus and religiosity, as well as have effects on various temporal dimensions; 3) important theoretical advances are needed to understand how temporal thought manifests itself in different types of measures, as well as the positive relationship between the past and the future; 4) the temporal focus that has the clearest relationship with other dimensions of temporal thought is the value temporal focus, and not the personal one; and 5) while time conceptualization varies across cultures, it does not seem to vary across religions.

It is my hope that our contribution will be a useful piece in understanding a little better how people of different cultures and religions think about time, and will serve to encourage more research on this complex topic.

Resumen

En la presente tesis doctoral examinamos, a través de seis estudios empíricos, cómo las personas de diferentes culturas (estadounidenses, españoles, serbios, bosniacos, croatas, marroquíes, turcos y chinos) y religiones o actitudes religiosas (principalmente cristianos, musulmanes, agnósticos y ateos) piensan sobre el tiempo. En particular, estudiamos el rol del foco temporal (es decir, la atención prestada al pasado y al futuro) y la religiosidad — factores que varían interculturalmente— sobre cinco dimensiones del pensamiento temporal: dónde situamos el pasado y el futuro, si delante o detrás (espacialización); la distancia que percibimos hacia eventos pasados y futuros; la similaridad de nuestro yo actual con el yo pasado y futuro (auto-continuidad); la valoración económica de eventos pasados y futuros (descuento); y cuán lejos situamos el horizonte al contemplar el pasado y el futuro (profundidad).

La mayor parte de nuestros estudios (estudios 1-4) estuvieron dedicados a examinar el rol del foco temporal y la religiosidad sobre la *asimetría* percibida entre el pasado y el futuro en las dimensiones temporales indicadas. Nosotros realizamos esta tarea con el fin de evaluar si la metáfora ATENDER ES VER juega un papel en el pensamiento temporal, de acuerdo a la Teoría de las Metáforas Conceptuales. Además, mostramos un estudio en proceso de elaboración (estudio 5) dedicado a examinar un tema de investigación complementario: el rol del foco temporal y la religiosidad sobre la *magnitud global* de las respuestas en tales dimensiones seleccionadas, para lo cual nos basamos en la Hipótesis de la Incertidumbre. Por último, tras comparar a personas de diferentes culturas en los estudios previos, usamos nuestros datos para examinar el rol de la religión en sí misma sobre todas las dimensiones temporales descritas (estudio 6). A continuación se describen los hallazgos relativos a estos temas.

El primer y principal tema abordado fue el estudio de la asimetría con la que se piensa con respecto al pasado y futuro, con el fin de examinar algunas de las metáforas conceptuales con las que pensamos sobre el tiempo. La Teoría de las Metáforas Conceptuales propone que para pensar sobre conceptos abstractos, como el tiempo, utilizamos conceptos concretos, como el espacio (así, pensamos de acuerdo a metáforas conceptuales como TIEMPO ES ESPACIO). Esta asociación puede nacer de la experiencia que tenemos cuando nos movemos hacia delante, ya que, al movernos, frente a nosotros están los eventos que viviremos en el futuro mientras que los eventos pasados

van quedando detrás. Esto implica que situamos el futuro delante de nosotros y el pasado detrás, lo cual es una asimetría en la espacialización temporal.

La experiencia corporal de caminar hacia delante puede hacer, además, que percibamos una asimetría futura en la distancia temporal (a medida que avanzamos, la distancia con respecto al futuro se comprime y se amplía con respecto al pasado), lo cual implica una relación negativa entre la percepción del pasado y el futuro. Esto, a su vez, podría afectar a la asimetría hacia el futuro con la que pensamos en las otras dimensiones temporales estudiadas (al sentirnos más similares a nuestro yo futuro que a nuestro yo pasado, descontar más las recompensas futuras que pasadas y tener horizontes temporales más largos hacia el futuro que hacia el pasado). Dado que todas las personas caminamos hacia delante, es razonable pensar que estos patrones de asimetría temporal hacia el futuro, nacidos de la metáfora conceptual TIEMPO ES ESPACIO, sean universales.

Sin embargo, podemos pensar sobre el tiempo en base a otras metáforas conceptuales, como ATENDER ES VER, lo que permitiría la existencia de asimetrías hacia el pasado. De acuerdo con esta metáfora conceptual, situamos delante de nuestros ojos aquello a lo que le prestamos atención. La Hipótesis del Foco Temporal aplica esta metáfora al pensamiento temporal y propone que si le damos más importancia al futuro, situaremos el futuro delante de nosotros, mientras que si le damos más importancia al pasado situaremos el pasado delante de nosotros. Según esta propuesta, las personas que le den más importancia al futuro que al pasado mostrarán el mismo patrón de asimetría hacia el futuro que también se espera desde la metáfora conceptual TIEMPO ES ESPACIO. Sin embargo, las personas que le den más importancia al pasado tendrán una asimetría hacia el pasado en espacialización, distancia, auto-continuidad, descuento y profundidad temporal. El objetivo principal de esta tesis fue valorar si la metáfora ATENDER ES VER juega un papel en el pensamiento temporal, para lo cual evaluamos a personas de culturas que varían ampliamente en la importancia que dan al pasado y el futuro a la búsqueda de variaciones en la asimetría en las dimensiones temporales seleccionadas.

La atención prestada al pasado frente al futuro (el foco temporal) puede definirse en términos del balance de atención prestada a los valores culturales de pasado frente de futuro (es decir, una cultura puede dar más importancia a los valores relacionados con el progreso —que son más seculares— o bien a los valores relacionados con la tradición que son más religiosos). A este tipo de foco temporal basado en valores culturales le

llamaremos *foco temporal de valores* y es el principal factor considerado en esta tesis doctoral. El foco temporal de valores no solo podría variar entre culturas, sino también durante crisis sociales (como la acontecida por la pandemia por COVID-19) junto con la religiosidad, debido a las estrategias de afrontamiento religiosas frente a seculares que las personas desarrollan para lidiar con tales crisis. Además, en la literatura previa encontramos otra concepción del foco temporal referida a la atención prestada a las experiencias personales pasadas versus futuras (es decir, a nuestro propio pasado o futuro autobiográfico), al que llamaremos *foco temporal personal.* Un objetivo colateral de esta tesis fue valorar si ambas definiciones de foco temporal miden el mismo constructo subyacente o no, usando ambas como predictores del pensamiento temporal.

Así, en esta tesis estudiamos el rol de ambos focos temporales y la religiosidad sobre la asimetría percibida en cinco dimensiones temporales (la espacialización, la distancia, la auto-continuidad y el descuento y la profundidad temporal), así como su variación durante la crisis social de la pandemia, y encontramos que:

- Tanto el foco temporal de valores como el personal variaron entre culturas. Además, la muestra recogida durante la pandemia mostró un mayor foco de valores hacia el progreso (futuro), una menor religiosidad y un foco temporal personal similar que los participantes recogidos durante la pandemia (estudios 1-5).
 - 2. Tal y como predice la Hipótesis del Foco temporal, el foco temporal de valores predijo la espacialización temporal: las personas de culturas orientadas a valores tradicionales tuvieron una mayor tendencia a situar el pasado delante de sí que las personas de culturas orientadas al progreso (estudio 1). Además, la intensificación del foco futuro en los valores durante la pandemia fue acompañada de una mayor tendencia a situar el futuro delante que antes de la pandemia (estudio 2). Por el contrario, no encontramos un efecto del foco temporal personal sobre la espacialización temporal.
 - 3. El foco temporal de valores tuvo un rol sobre la asimetría percibida en otra de las dimensiones temporales estudiadas: el descuento temporal, de modo que a mayor importancia dada a los valores progresistas (frente a los tradicionales), mayor tendencia a elegir una recompensa mayor en el futuro que en el pasado (estudio 3). Además, la intensificación del foco futuro en los valores durante la pandemia fue acompañada de una mayor tendencia a elegir una recompensa

mayor en el futuro que en el pasado (estudio 4). Sin embargo, ni el foco temporal de valores ni el personal tuvieron un efecto en ninguna otra asimetría temporal (encontramos un patrón de asimetría general hacia el futuro en la autocontinuidad y la profundidad temporal; y un patrón de simetría temporal en la distancia temporal).

Gran parte de los hallazgos mostrados apoyaron la propuesta de que las personas piensan en el tiempo de acuerdo a la metáfora ATENDER ES VER (lo que no es incompatible con que use también la metáfora TIEMPO ES ESPACIO según el contexto y la tarea): aunque la asimetría general en las diversas dimensiones es hacia el futuro, esta tendencia puede ser modulada e incluso revertida debido al foco temporal de valores, que varía entre culturas y durante crisis sociales.

Sin embargo, también encontramos evidencia que choca directamente con las predicciones de ambos modos de pensar sobre el tiempo. En primer lugar, en contra de lo esperado desde la metáfora TIEMPO ES ESPACIO, todas las tareas mostraron una clara correlación positiva entre la magnitud de las respuestas hacia el futuro y hacia el pasado: las personas que perciben más distancia a un evento en el futuro, también perciben más distancia a un evento en el futuro, también perciben más distancia a un evento pasado situado a la misma distancia objetiva; las que descuentan más los eventos futuros, también descuentan por igual los eventos pasados; etc. En segundo lugar, en contra de lo esperado desde ambas metáforas conceptuales, no hubo asimetría en distancia temporal. Además, las distintas medidas de pensamiento temporal no correlacionaron entre ellas, mostrando que el pensamiento sobre el tiempo es multidimensional y que no se puede entender desde un único factor subyacente. Estos datos sugieren cierto grado de adecuación de los planteamientos teóricos de partida, pero también la necesidad de futuros desarrollos teóricos.

De forma colateral a los hallazgos previos, nosotros encontramos que ambas medidas de foco temporal estaban disociadas y se relacionaban en direcciones opuestas con la religiosidad: a mayor religiosidad, menor atención a los valores de progreso y mayor atención al futuro personal. Nosotros creemos que estas relaciones se pueden entender desde la Hipótesis de la Incertidumbre, que propone que las personas de entornos económicos más inseguros son más religiosas que las de entornos seguros. En un análisis exploratorio vimos que los países de las culturas más religiosas y tradicionalistas en nuestra muestra, y que piensan más en su futuro personal, tienen efectivamente economías más débiles e inestables (medidas mediante el GDP per cápita de cada país) que las

culturas del grupo opuesto. Probablemente, la inestabilidad del entorno que habitan induce una búsqueda de estabilidad, lo que les lleva a ser más tradicionales y religiosos, así como a focalizarse en su futuro personal más que en su pasado.

Una vez desarrollado el tema de la asimetría temporal, abordamos el segundo tema de investigación principal de la tesis: el rol del foco temporal y la religiosidad sobre la *magnitud global* percibida en las dimensiones temporales (estudio 5). Mientras que en el estudio de las asimetrías temporales atendíamos a la *diferencia* de magnitud entre las respuestas dadas en las distintas tareas a los ítems de pasado frente a los de futuro, en este caso nos centramos en la magnitud global de las respuestas. Esperábamos, desde la Hipótesis de la Incertidumbre, diferencias entre las personas de culturas con economía más inestable (que son más religiosas, más orientadas a valores de pasado y más focalizadas en su futuro personal) y aquellas con economía más estable. La inestabilidad del ambiente dificulta la capacidad de hacer predicciones, lo que puede aumentar la distancia temporal percibida y disminuir la auto-continuidad. Junto con la necesidad más inmediata del dinero, la impredecibilidad puede aumentar el descuento temporal. Además, la búsqueda de estabilidad que aumenta la religiosidad y tradicionalidad puede llevarles también a pensar con horizontes temporales más lejanos.

Nuestros resultados no encontraron diferencias entre los grupos culturales con economías más y menos estables en la distancia temporal y la auto-continuidad, pero sí apoyaron las predicciones respecto al descuento y la profundidad temporal. A continuación, examinamos si la llegada de la pandemia pudo afectar a la magnitud percibida es estas dimensiones. Predijimos que el aumento observado en valores de futuro y la disminución en la religiosidad durante la pandemia (referido previamente) iría acompañado de una disminución del descuento y los horizontes temporales, lo cual corroboramos, aunque solo en el grupo cultural con economía más estable. Creemos que la pandemia no llegó a afectar a las culturas con economía más inestable en estas dimensiones dado que ya partían de un alto grado de inestabilidad. Además, observamos un hallazgo adicional: un aumento global de la percepción de la distancia temporal durante la pandemia (un intervalo de un mes se percibía más lejano que antes) en ambos grupos culturales, consistente con un paso del tiempo más lento durante el confinamiento.

Por último, tras haber estudiado la variación cultural en la asimetría y la magnitud global percibida en la espacialización, distancia, auto-continuidad, descuento y profundidad temporal, nosotros pasamos a explorar la variación inter-religiosa en todas

estas dimensiones (estudio 6). Dado que la religión es un factor esencial de la cultura con capacidad de modular la cognición de las personas, pensamos que podría afectar a las dimensiones temporales, aunque no teníamos hipótesis previas en ninguna dirección. Sin embargo, nuestros resultados mostraron que la religión (al menos al comparar a cristianos y musulmanes) no jugó ningún papel relevante en ninguna medida, ni de asimetría ni de *magnitud global*. Se necesita más investigación con otras religiones para terminar de aclarar esta cuestión

La tesis doctoral finaliza discutiendo los hallazgos realizados en relación al marco teórico del que se derivan y concluye 1) que pensamos sobre el tiempo de acuerdo a un conjunto de metáforas conceptuales que pueden hacernos pensar de forma asimétrica hacia el pasado y hacia el futuro; 2) que factores ambientales como la llegada de crisis sociales o la inestabilidad económica del país pueden modular el foco temporal y la religiosidad, así como tener efectos en diversas dimensiones temporales; 3) que son necesarios avances teóricos importantes para entender cómo se manifiesta el pensamiento temporal en distintos tipos de medidas, así como la relación positiva que se da entre el pasado y el futuro; 4) que el foco temporal que tiene una relación más clara con otras dimensiones del pensamiento temporal es el foco temporal de valores, y no el personal; y 5) que mientras que la conceptualización temporal varía entre culturas, no parece variar entre religiones (al menos entre cristianos y musulmanes en las dimensiones estudiadas).

Confío en que nuestra aportación sea una pieza útil para comprender un poco mejor cómo las personas de diferentes culturas y religiones piensan sobre el tiempo y sirva para fomentar más investigación sobre este complejo tema.



CHAPTER I: INTRODUCTION
The Janus god and the human conceptualization of time

Quem tamen esse deum te dicam, Iane biformis? nam tibi par nullum Graecia numen habet. ede simul causam, cur de caelestibus unus sitque quod a tergo sitque quod ante vides

[But two-formed Janus what god shall I say you are, since Greece has no divinity to compare with you? Tell me the reason, too, why you alone of all the gods look both at what's behind you and what's in front.] (Ovid, *Fasti* 1, 89-92)

How do we think about time? The figure of Janus is revealing. Janus was an important god in roman mythology (Purcell, 2022) who received a long-lived cult with a special emphasis during the Augustan period (O'Keefe, 2021). Janus was considered the overseer of time associated with the calendar and the month of January (Blasco, 2013; O'Keefe, 2021). Janus had a head with two faces: one looking forward and the other backward, one looking to the past and the other simultaneously looking to the future (Wiseman, 2004), but it seems unclear whether the Romans thought that Janus was looking to the future with his front face or with his back face. They did think he was focused on whatever he placed in front of his forward face, although he connected both temporal moments, past and future, like a bridge or a door (Holland, 1961).

What does the figure of Janus reveal to us about how we think about time? First, it shows that we use space to think about time: We, like Janus, represent the past and the future as if they were placed in front and behind of us. Second, it suggests that although we are between these two temporal moments, we are focused and pay more attention on what we place in front of us, whether the past or the future.

Why do we use space to think about time? One influential proposal is Conceptual Metaphor Theory (CMT; Lakoff & Johnson, 1980, 1999; see also Boroditsky, 2000; Casasanto & Bottini, 2013; Clark, 1973; Landau et al., 2010; Núñez & Sweetser, 2006; Soriano, 2012). Time is an abstract concept in the sense that we cannot directly experience it, maybe only except for the experience of change during brief intervals (James, 1890). But, in order to entertain and reason about wider intervals, the mind is at a loss. CMT

proposes that to think about abstract concepts, such as time, we use concrete concepts, such as space, what the theory calls a *conceptual metaphor*. Such conceptual correspondences structure meaning and are the constitutive strategy of abstract thought (Lakoff & Johnson, 1980). Thus, we can think about the abstract concept of time according to the conceptual metaphor TIME IS SPACE. Concrete concepts rely on repeated perceptual-motor patterns that arise in the interaction with the world (Barsalou 1999; Gallese, 2008; Gallese & Lakoff 2005; Gibbs, 2006; Glenberg, 1997; Lakoff & Johnson 1999; Pecher et al., 2011; Zwaan, 2003; for origins in phenomenology see Merleau-Ponty, 1945, 2003). Repeated experiences produce *image schemas* which then provide patterns of understanding and reasoning (Johnson, 1987; for an extended discussion, see Hampe & Grady, 2005). Conceptual metaphors are based on those image schemas.

Lakoff and Johnson (1980) discussed several conceptual metaphors that are used to talk about time (such as TIME IS A RESOURCE, TIME IS A CONTAINER or TIME IS A CHANGER), but the predominant alternative is TIME IS SPACE (see Bonato et al., 2012, and Núñez & Cooperrider, 2013, for reviews; see also Boroditsky, 2000; Boroditsky & Ramscar, 2002; Casasanto & Boroditsky, 2008; Moore, 2006; Torralbo et al., 2006; Weger & Pratt, 2008). Indeed, there are spatial metaphors for almost all aspects of time (Clark, 1973; Evans, 2004, 2013; Lakoff & Johnson, 1980, 1999; Moore, 2006, 2014; Radden, 2004). Moreover, the association of temporal constructs, such as past or future, with specific locations in space is common in most languages (see Alverson, 1994; Haspelmath, 1997) and is manifested in both speech and gesture (e.g., Boroditsky, 2000, 2001; Carrión & Valenzuela, 2021, 2022; Majid et al., 2013; McNeill, 2008; Núñez & Sweetser, 2006; Tenbrink, 2008; Valenzuela & Alcaráz Carrión, 2020).

The association between time and space can arise from the sensorimotor experiences of motion (Clark, 1973; Condillac, 1746/1971; Gallese & Lakoff, 2005). These experiences generate a PATH image schema, in which something moves from a source location to a goal location through a path. Specially relevant for the human mind are the experiences of moving forward to reach a destination. This spatio-temporal link implies that we think of time as our movement along a mental time line in an analogous way as to how we travel in space (Clark, 1973). As we walk forward, in front of us there are the things and events that we will experience in the future and behind us there are the things and events of the past. This is the basis of the past-behind/future-ahead mapping.

That we think about time in this way has been supported by evidence showing that when we think about future events we sway forward and when we think about past events we sway backward (Macrae et al., 2012; Miles, Nind, et al., 2010), among several other research lines. There is also complementary neuroscientific evidence showing a common neural substrate underlying travel through both space (i.e., navigation) and time (i.e., memory and retrospection; Buckner & Carroll, 2007). In this context, it seems likely that the Romans could think that Janus — who moved forward and was considered the embodiment from which the symbols of paths and transitions, both spatial and temporal, are born (Roman & Roman, 2010) — looked to the future with his front face and to the past with his back face.

The complexities of human spatial cognition afford other possible ways to think about time. In particular, there are two other spatial axes that can be used to map time: the horizontal (Miles, Betka, et al., 2010; Ouellet et al., 2010; Santiago et al., 2007; Santiago et al., 2010) and the vertical (Boroditsky et al., 2011; Gu, et al., 2019; Yu, 2012)¹. However, the sagittal axis enjoys preeminence when people mentally integrate time with space, possibly because of the biological relevance of the bodily experience of moving forward. It is the main axis used to communicate about time in a majority of languages in the world (Haspelmath, 1997; Radden, 2004), as when an English speaker says "in the year ahead of us", "back in the last year", "looking forward to the next month" or "looking back to last month.", and it is also spontaneously employed when processing temporal constructs (e.g., Miles, Karpinska, et al., 2010; Miles, Nind, et al., 2010). In sum, the experiences of motion make us associate time with space, and the experiences of moving forward to reach destinations make us tend to conceptualize and speak about the future as if it were in front of us and the past behind.

Frontal space also maintains a strong relationship with the focus of attention: we orient ourselves toward those things that we are interested in or that attract our attention

¹Although the most common representation of Janus is with two faces looking forward and backward, as pictured on the cover of this dissertation, he has sometimes been depicted with four faces, i.e. with two additional faces looking to the right and left. Dixon-Kennedy (1998) suggested that possibly the Romans believed that Janus not only looked to the past and future simultaneously on the sagittal axis, but also on the horizontal one. This is another teaching from Janus about temporal conceptualization.

and we approach them to examine them closely. As we pay more attention to what we place in front of us, the experiential basis that makes us place the future in front may also make us to be future-focused, that is, to pay more attention to the future than to the past (de la Fuente et al., 2014). Could this, in turn, lead us to additional future asymmetries of thought and evaluation? For example, do we feel that future events are closer to us and are more valuable than past events? Do we have deeper temporal horizons into the future than the past? Many other questions arise. In case we were future-focused, is it only due to the experience of moving forward or could there also be cultural factors at play? If it all depends on how the human body moves in space, this way of thinking about time should be universal, but if culture had a role, the placement of future and past in front or behind and additional temporal asymmetries could vary between the world's cultures. Are there cultures in which people are past-focused? If so, would they show smaller or reversed temporal asymmetries (e.g., placing the past in front or feeling the past as closer than the future)? These are some of the main questions of the present doctoral dissertation. In the course of the Introduction, I will review what is known about these questions.

The supremacy of the future

Heading to the future

What are the implications of the TIME IS SPACE conceptual metaphor for our conceptualization of time? As discussed above, the first implication is the past-behind/future-ahead mapping in time spatialization. A second implication is that the same perspectives that can be applied to motion events can also be applied to time. Much research have focused on two of them, called the ego-moving and time-moving perspectives. We have presented the ego-moving perspective above (see Boroditsky, 2000). When taking this perspective, we move along the time line from the past into the future. To exemplify this construal lets think of the time line as a train stopped at a train station. In this train, the sequence of cars corresponds to the sequence of events, e.g., the first car corresponds to breakfast, the second to lunch and the third to dinner. Under an ego-moving perspective, we conceive of ourselves as moving forward in the platform or inside the cars along the train, from the head car toward the rear cars. In this perspective, the cars in front of us correspond to future events and those we are leaving behind correspond to past events (see Santiago, 2022). This perspective is implicit in expressions

such as "We are approaching Christmas." In contrast, the time-moving perspective (Lakoff & Johnson, 1980; see also Boroditsky, 2000) arises when we stay still and the series of future events moves towards us, become present when they reach us and past when they have passed toward our back. Continuing with the train analogy, in this case we would not be walking inside the train, but would be standing outside and looking at it while the train moves toward us (Santiago, 2022). This is reflected in expressions such as "Christmas is approaching."

In addition to temporal spatialization (i.e., the placement of the future and the past either in front or behind), the use of the TIME IS SPACE conceptual metaphor may have additional implications. For example, it can make us feel that the future is closer to us than the past (Caruso et al., 2013): as we walk, we get increasingly closer to the future (which we place in front of us), so the distance to it compresses while the distance to the past (which we place behind us) broadens. Caruso et al. (2013) showed that when asked to estimate the distance to a future (vs. a past) event, people judged the future event to be closer to the present than the past event, even though the objective temporal distance was the same. This was called the Temporal Doppler Effect (TDE), and implies that the past and the future have a negative relationship when events located at the same objective temporal distance from the present are considered: the smaller the perceived distance to the future, the greater the perceived distance to the past. This effect is independent of whether we adopt an ego-moving or a time-moving perspective (Aksentijevic & Treider, 2016). However, the evidence for the TDE is unclear: some studies have reported a TDE (e.g., Burns et al., 2019; Caruso et al., 2013), but others have challenged it (e.g., Aksentijevic & Treider, 2016; Liefgreen et al., 2020; Loeffler, et al., 2017).

If the use of the TIME IS SPACE conceptual metaphor makes us feel the future closer than the past, this asymmetry in temporal distance might, in turn, cause other related asymmetries. First, it could imply that we feel ourselves to be closer and therefore more similar to our future selves (how we think we will be in the future) than to our past selves (i.e., a future asymmetry in self-continuity; for evidence of an effect of subjective distance on perceived self-continuity, see Ji et al., 2019). Second, as we feel the future is closer than the past, we will be more likely to prefer a larger financial reward in the future than the past versus a smaller financial amount in the present (i.e., a future asymmetry in time discounting; for evidence on the relationship between time distance and time discounting see Cooper et al., 2013; Croote et al., 2020; Holmqvist et al., 2015; and

Zauberman et al., 2009). For example, we would prefer \$20 in a week versus \$5 today, but not \$20 a week ago versus \$5 today. Finally, it may imply that our time horizons are longer into the future than into the past (i.e., a future asymmetry in temporal depth): if the subjective distance to the future contracts, we will have the capacity to look further into the future, that is, to reach a deeper time horizon into the future than into the past.

However, there is an alternative explanation for the existence of the future in front mapping and for the future asymmetries in temporal distance, self-continuity, time discounting, and temporal depth, which is not related to the experiences of forward motion. These asymmetries might arise instead because people favour the future over the past, either because of idiosyncratic reasons or because of the cultural norms and values in which they have been raised. This preference for the future may make the individual to pay more attention to the future than to the past and to give it a better affective evaluation. It is difficult to disentangle causal relations among these factors, but there is evidence that people tend to pay more attention, give better evaluations, simulate in more detail, and feel greater affect and emotion when contemplating future versus past events (see Callender, 2017; Caruso, 2010; Caruso et al., 2008; Suhler & Callender, 2012). In the following paragraphs I show how paying more attention to and valuing the future (i. e., being future-focused) could produce asymmetries in the temporal dimensions for reasons unrelated to the bodily experience of moving forward, and I will devote the next two sections to discuss whether and how culture may discriminate in favour of the future or the past.

First of all, the fact that we give more importance to the future than to the past may cause the tendency to represent it in front of us. As mentioned above, this would happen when we conceptualize time not according to the TIME IS SPACE conceptual metaphor but according to another conceptual metaphor, ATTENDING IS SEEING, which maps attended things or events (such as future events) to the space in front of the person while unattended things or events (such as past events) are mapped on the space behind. If we (mentally) place in front of us what we pay attention to, and if we attend to the future more than to the past, it follows that we will tend to place the future in front and the past behind (de Fuente et al., 2014).

Second, giving more importance (and thereby paying more attention) to the future than to the past could cause an asymmetry in perceived distance. Because of the difference in attention, future events may be mentally simulated in more detail than past events

(Caruso et al., 2008; Ji et al., 2009; Suhler & Callender, 2012). According to Construal Level Theory (CLT; Trope & Liberman, 2003, 2010), there is a relation between the construal level at which we think about events and the subjective distance we perceive between those events and us: the higher the level of concreteness (vs. abstraction) at which we think about them, the closer we feel to them (and vice versa, as the theory predicts a bidirectional relation). Thus, if we represent future events with more clarity and detail (i.e., concreteness) than past events, we might feel closer to future events than to past events (for supporting evidence, see Fujita et al., 2006; Ji et al., 2009; Semin & Smith, 1999). The asymmetry in time distance produced by representing future events in more detail than past events could in turn explain additional future asymmetries in self-continuity, time discounting, and temporal depth for the same reasons.

Finally, valuing the future more than the past could also have an effect on asymmetries in time discounting independently of asymmetry in time distance: if we value the future events more, we will find the future reward more valuable than the past reward (see Guo et al., 2012) and we will tend to discount less in the future than in the past.

To put it all in a nutshell, there are two possible mechanisms to explain the future in front mapping and the future asymmetries in time distance: First, by the use of the TIME IS SPACE conceptual metaphor, the future is in front (because we reach future events when we move forward or when they move toward us) and the future feels closer than the past. Because of this asymmetry in time distance, asymmetries in other temporal dimensions such as self-continuity, time discounting, and temporal depth may also follow. Second, the fact that we pay more attention to future events than to past events, value them more, and think in more detail about them may cause us use the ATTENDING IS SEEING conceptual metaphor and, therefore, to represent the future events in front and closer (as can be derived from the Construal Level Theory) than past events. The putative future asymmetries in self-continuity, time discounting, and temporal depth, might arise from the asymmetry in perceived temporal distance or have other origins related to being future-focused. These two alternatives work in the same direction in those cultures and individuals that give more importance to the future than the past, but dissociate in cultures that value more the past than the future.

Culturally oriented to progress

But only in Western Civilization, apparently, does the idea exist that all history may be seen as one of humanity improving itself, step by step, stage by stage, through immanent forces, until at some remote time in the future a condition of near-perfection for all will exist.

(Robert Nisbet, The idea of progress, 1979)

Culture could enhance the future focus and foster asymmetries toward the future in our temporal thought by promoting the cultural value of progress? The word *progress* comes from the Latin *progressus* which means to move forward. Progress is a cultural value which indicates that as we move forward to the future we have to improve and perfect ourselves (Nisbet, 1979; Shils, 1981). The value of progress could affect how we think about time: first, it could activate the metaphor TIME IS SPACE, focusing us on the idea of moving forward. In this way, it could make us think that the future is ahead and closer to us than the past. Second, the value of progress could focus us on the future, making us believe that the future is more valuable than the past, since progress conveys the notion that both we and society will be better and better in the future (because we will perfect ourselves over time). Thus, progress could enhance future asymmetries (in time spatialization, distance, continuity, discounting, and depth) born from both the experience of moving forward and having an attentional focus on the future, and transmit this pattern of thought at the societal level as a cultural value.

The value of progress is associated with the idea that humans and societies will be improved through technical-economic development (Nisbet, 1979) and encourages us to develop technology that will allow us to do things better in the future and also to invest money that will give us a bonus in the future and allow us to live in better conditions. Thus, Safranski (2017) stated that with the idea of progress we recognize ourselves as *Homo oeconomicus* and *Homo technicus*, and move into a technically dominated, achievement-, efficiency-, and goal-driven compass. In addition, progress could emphasize the future asymmetry in temporal distance making us feel the future closer than the past. Safranski (2017) explained that this could occur because the pace of life accelerates through the logic of production and efficiency that characterize progressivism: if our pace accelerates and we place the future in front of us, we may feel that we are

getting closer and closer (and faster and faster) to the future. Production and investment entail future risks that we have to think about in the present. Time is so accelerated that the future is reached very quickly. It is very close and is no longer distinguishable from the present.

Furthermore, as discussed above, the future asymmetry in time distance could imply future asymmetries in other temporal dimensions, such as self-continuity, time discounting, or temporal horizons (because it would make us feel that there is less distance to our future-self, the future reward, and the future horizon than to our past-self, the past reward, and the past horizon). Alternatively, the idea of progress may make us value the future more than the past and this, in turn, may produce future asymmetries independently of the perceived time distance. For example, the idea of investment and obtaining a future benefit that accompanies the idea of progress since modernity (Nisbet, 1979) could lead us to discount less in the future than in the past (regardless of whether or not we feel it is closer than the past); or, given that progress drives the idea of development and improvement, we could need to plan for the long term in the future, and this could produce a future asymmetry in our time horizons.

Importantly, the idea of progress is not universal but is mainly linked to Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies (Henrich, 2020; Henrich et al. 2010). These societies are characterized as individualistic, non-conformist, analytical, and control-oriented. Thinking about time represented as a line in space together with the idea that future is a valuable resource co-evolved with the notion of progress in WEIRD societies (see Graham, 1981; Santiago, 2022). Thus, WEIRD societies may strengthen the importance of the future over the past in temporal thought by training the cultural value of progress, diverting attention from the cultural value of tradition, and thereby promoting the idea that the future is placed in front of us, we are moving forward toward it at ever increasing speed, and making it feel closer and more positively evaluated than the past. But since the value of progress and the focus on the future does not have supremacy in all cultures, it is likely that there are cultures that do not embrace this way of thinking about time.

What if the past had supremacy?

There are many ways to conceptualize time across cultures

Sapir (1921/1949) and Whorf (1956) proposed that culture-specific factors shape cognition. This also applies to temporal cognition: People from different cultures conceptualize time differently and this, in turn, has practical consequences on how they feel and act (Gell, 1992). However, the sociocultural particularities of temporal thought are not obvious, which is why Hall and Hall (1959) considered that time is one of the main elements underlying each culture's implicit codes of behavior, which they named "the silent language". Therefore, to understand people's temporal conceptualization, it is necessary to study the role of culture.

Culture can create habits of thought that can influence the choice of conceptual metaphors by which people think about abstract concepts. According to Lakoff and Johnson (1980, 1999), conceptual metaphors are connections between abstract and concrete concepts that are established in long-term memory and are stably and solidly based on sensorimotor experiences. This implies that these conceptual associations could be universal and automatic. However, the way we think according to conceptual metaphors depends not only on bodily experiences but also on our language and culture (Casasanto, 2014). Furthermore, flexibility has been found in the use of conceptual metaphors (Santiago et al., 2011). Thus, although metaphors are based on largely universal bodily experiences, culture plays a role in selecting the specific experiences on which conceptual metaphors for time (among other abstract concepts) are built (see de la Fuente et al., 2014; Núñez & Sweetser, 2006; Santiago et al., 2011).

How does flexibility occur? Santiago et al. (2011) suggested that differently to what was proposed in the original view of the Conceptual Metaphor Theory, for each abstract domain there is a variety of metaphors available in long-term memory, from which we select at each moment the one that best fits the problem, its context, and our goals. Attention activates metaphors from long-term memory when something in the environment serves as a cue or because they are more salient or of more frequent use in a particular context. The metaphors that best cohere with the other content simultaneously present in working memory will be maintained (see Santiago et al., 2011; see also support for the proposal in Gozli et al., 2013; and for support to the idea that conceptual congruency effects are contextual, see Lakens et al., 2012; Santiago et al., 2012; Torralbo

et al., 2006). Thus, we conceptualize time flexibly according to the attentional dynamics that vary among tasks, individuals, and cultures (Torralbo et al., 2006). Culture, in particular, can establish attentional biases that become habits (see Bender & Beller, 2011; D'Andrade, 1995; Kroeber & Kluckhohn, 1952) and these habits can lead to the maintenance of particular ways of thinking that affect how people conceptualize time (Dahl, 1995; Grebe, 1990; Klein, 1987). This could be done by activating some conceptual metaphors versus others, or by preferring some perspective over other in the context of the same conceptual metaphor.

There are numerous examples of variability in temporal conceptualization across cultures (Núñez & Cooperrider, 2013). For example, regarding the linear conceptualization of time on the horizontal axis, available evidence shows that the directionality of this mapping is affected by the writing system. This is why the future is to the right in cultures with left-to-right reading and writing direction but it is to the left in cultures with right-to-left scripts, as shown by experimental tasks (Bergen & Chan Lau, 2012; Casasanto & Bottini, 2010; Fuhrman & Boroditsky, 2010; Ouellet et al., 2010) and spontaneous gesture (Casasanto & Jasmin, 2012; Cienki, 1998; Cooperrider & Núñez, 2009).

Culture also affects time conceptualization on the sagittal axis as shown by the fact that using the future-front and past-back mapping is not universal (see Núñez & Cooperrider, 2013). For example, for the Aymara speakers, the past is placed in front of the ego and the future behind. Núñez and Sweetser (2006) proposed that this is because, when conceptualizing time in its relationship with the ego, the Aymara people do not use the TIME IS SPACE conceptual metaphor but rely on the KNOWLEDGE IS VISION conceptual metaphor. This metaphor stems from the also universal experience that humans have of the relationship between vision and knowledge. Importantly, vision implies an asymmetry when observing space: things behind the ego are visually inaccessible, hence unknown, while things in front of the ego are visually accessible and known. In temporal experience, the past is known, whereas the future is unknown and this is why the future is in front. The authors suggest that this may occur in the Aymara culture because of a possible special emphasis in visual perception as a source of knowledge (which could be even stronger than in many other cultures due to the distinction the Aymara make between first-person and non-first-person knowledge). Earlier I discussed another metaphor that supports thinking about time on the sagittal axis: ATTENDING IS SEEING, by which people who are oriented to progress and future values tend to place the future in front. The way of thinking about time based on this metaphor may also vary across cultures: Some cultures do not have a focus on progress and the future but place instead attention on traditional values, causing people to pay more attention to the past than to the future. According to the ATTENDING IS SEEING conceptual metaphor, that could make these people place the past in front of them (de la Fuente et al., 2014). The focus on the past could give rise to additional past asymmetries in temporal distance, self-continuity, discounting, and depth. I discuss this possibility in the next section.

Culturally oriented to tradition

'Traditional' is used to designate whole societies which change relatively slowly, or in which there is a widespread tendency to legitimate action by reference to their having occurred in the past or in which the social structure is a function of the fact that legitimations of authority tend to be traditional.

(Shils, Tradition, 1981)

Culture can modulate temporal focus, i.e., the attention people give to cultural values related to the past and tradition versus to the future and progress (Gell, 1992; Ricoeur, 1979a, 1979b). In the previous section, we showed that the WEIRD (Western, Educated, Industrialized, Rich, and Democratic) societies are progress-oriented. However, this pattern is not universal. In fact, despite being the most represented in psychological studies, WEIRD societies account for only a small part of the world's cultural variability (Henrich et al., 2010). Other cultures may be oriented to traditionalist temporal values, where a past focus predominates (e.g., Guo et al., 2012; Inglehart & Baker, 2000).

The word *tradition* comes from the Latin *traditio:* to transmit, to hand over, and in the most basic sense, means something that is transposed from the past to the present (see Yves Congar, 2016). The cultural value of tradition can be conceived of as the preservation of meaning within a particular community across time and it has strong implications for how to act: repeating things as they were done in the past is the preferred way to face and organize the future (Shils, 1981). Thus, it has been considered a major

social force affecting society's behavior (Hibbert & Huxham, 2010; Ruthven, 2004). Tradition is most of the times conceived in contrast to progressivism. In WEIRD societies, the dissociation between traditionalism and progressivism occurred especially during the Enlightenment (Giddens, 2003; Shils, 1981), when progressivism promoted the idea of change, moving forward, and improvement, while traditionalism promoted the conservation of customs². This dissociation (but not necessarily an opposition) between these cultural values tarnishes today's societies, focusing some of them on progress and others on tradition.

What if we were wrong about Janus and the Romans? We described Janus at the beginning of the Introduction as being future-focused because he would walk forward, so he would place the future in front and give more importance and attention to what is in front of his front face. However, the literature indicates that the Romans attributed to Janus a focus on the past: they conceived him as a survivor from deep antiquity (O'Keefe, 2021). In this sense, the poet Ovid wrote that Janus described himself by saying "I am an item from the past" (Ovid, 12/1931; see also Frazer, 1932; Wiseman, 2004). It could be that the Romans believed that Janus was past-focused. The evidence also indicates that the Romans themselves may have been past-focused since they preferred to utilize or revive old, traditional customs rather than introduce new and radical ideas (O'Keefe, 2021; even though the idea of progress already existed in classical Roman society, see Nisbet, 1979).

Like could be the case of the ancient Romans, people from many cultures today place the value of tradition over modernity and progress and are culturally oriented to tradition (Inglehart & Baker, 2000), i.e., they are past-focused. This could mean that the future asymmetries of temporal thought might be modulated in these cultures. Thus, while in the cultures oriented to the future and progress it seems more likely that people tend to think that the future is in front of them, feel the future closer than the past, feel more similar to their future than to the past self, discount delayed rewards less toward the future than toward the past, and have longer time horizons into the future than into the past, the

²Note that, although this is the predominant view, there are also proposals indicating a positive relationship between traditional values and openness to change and innovation (e.g., Toren, 1988).

opposite patterns could occur in cultures where the value of tradition and the past predominates.

First, a traditional temporal focus that prioritizes the value of the past over the future could have implications for time spatialization. Unlike the idea of progress, the idea of tradition is not related to the experience of moving forward. This could lead traditional cultures to focus not on the TIME IS SPACE conceptual metaphor, but on other conceptual metaphors such as ATTENDING IS SEEING. Moreover, unlike progress, tradition implies that the past is more important than the future, which could lead to paying more attention to the past and explain why people from traditional cultures could place the past in front, a hypothesis that de la Fuente et al. (2014) called the Temporal Focus Hypothesis (TFH henceforth; see also Callizo-Romero et al., 2019). De la Fuente et al. (2014) found this mapping when comparing samples of Spanish and Moroccan participants: Moroccans were more oriented to the past and tradition than Spaniards, and the majority of Moroccans placed the past in front of them while the majority of Spaniards placed the future in front of them. If the Romans were past-focused, they likely thought that Janus (which they conceived of as also being past-focused) placed the past in front of him and the future behind him, just as the Romans themselves might place it with respect to their bodies.

Second, the past focus could produce a past asymmetry in temporal distance. If culture makes people pay more attention to the past and values it more than the future, the past may come to be represented in more detail and, according to Construal Level Theory (see Liberman & Trope, 1998; Trope & Liberman, 2003), this could produce past-oriented people feeling the past closer to themselves than the future (past asymmetry in time distance; see also Holmqvist et al., 2015; Ji et al., 2009). From here, the other asymmetries may follow: if we feel the past closer to the present than the future, we might also feel our past-self closer than our future-self (that is, a past asymmetry in self-continuity); feel the past reward as closer than the future one and therefore discount less in relation to the past than to the future (a past asymmetry in time discounting); and have longer horizons into the past than into the future (a past asymmetry in temporal depth).

Alternatively, a past focus could also affect temporal asymmetries but not because of psychological distance, but for other reasons. Thus, temporal focus could affect only some temporal dimensions and their asymmetries. For example, if we value the past more than the future, we may tend to choose a farther and greater reward in the past than in the

future, just because the past reward is more valuable for us than the future one (Guo et al., 2012). Similarly, we may have deeper horizons into the past than into the future just because we think more about what happened in the long-term past than in what might happen in the long-term future.

Importantly, whereas the TIME IS SPACE and the ATTENDED IS SEEING conceptual metaphors make similar predictions in future-focused cultures, and therefore the data cannot provide independent support for each one, they make contrasting predictions in past-focused cultures. Only the ATTENDED IS SEEING conceptual metaphor predicts that past-focused cultures should show a tendency to place the past in front as well as asymmetries toward the past in time distance, self-continuity, time discounting, and temporal depth. If we find this pattern of results, we will have found evidence that supports that the ATTENDING IS SEEING metaphor is making an independent contribution to time conceptualization. This pattern would also be consistent with the ATTENDING IS SEEING metaphor.

Social crises, religiosity, and temporal focus

The temporal focus on progress (future) versus tradition (past) may also vary in response to social crises due to coping strategies: people in times of crisis tend to rely on something that offers them psychological security, reduces the impact of stressors, and is a tool to overcome the crisis. This process is known as coping and can be religious or secular (Riegel & Unser, 2021).

Through religious coping strategies, people affected by a crisis seek psychological security in religion (Ano & Vasconcelles, 2005; Pargament, 1997; Park & Cohen, 1993). Religion offers motifs, symbols, and stories to reappraise situations and thereby ascribe meaning to them (Riegel & Unser, 2021). It also offers the belief that the divinity can resolve crises. Thus religious coping leads to increases in religious behaviors such as seeking a connection with God, seeking support from congregation members, or giving religious help to others. Religion correlates positively with traditional values (Saroglou et al., 2003; Schwartz & Huismans, 1995), so an increase in religiosity during social crises may be accompanied by an intensification of past focus. People's tendency to religious coping depends on variables such as, for example, their previous degree of religiosity (the

greater the religiosity, the greater the religious coping; see Baldacchino & Draper, 2001) or their age (the older, the greater the religious coping; see Ahmadi & Ahmadi, 2017).

Another type of strategy that can be used during social crises is secular coping (Hampson et al., 1996; Murberg et al., 2004) whereby people seek to overcome the crisis they are in by fostering secular ideas and non-religious-related behavior, such as relying on technological-scientific development (Riegel & Unser, 2021) or volunteering to help those in vulnerable situations (McDougle et al., 2015). In addition, secular coping strategies could lead people to rely on the state rather than on religion as the best force to end the crisis and thus promote secularization processes (Bruce & Voas, 2016) which, in turn, could be accompanied by an increase in progressive values (Norris & Inglehart, 2011).

Janus and the relationship that the Romans had with him are again revealing. It seems the Romans used religious coping during periods of social crisis, such as the one resulting from the battle of Actium in 31 B.C.E. which made them feel devastated (Zanker, 1988). The deity that the Romans chose to deal with these feelings and face the crisis was Janus, through which they believed the image of the past could be purified to preserve order for the future (Liebeschuetz, 1979; O'Keefe, 2021). So, it seems that the Romans intensified their past/traditional-focus during this crisis due to religious coping associated to the figure of Janus. Would the same occur today? During the development of the research that led to the present dissertation, the world faced an unprecedented social crisis: the Covid-19 pandemic. Could it change people's temporal focus? If so, would it increase people's traditional values (through religious coping) or progressive values (through secular coping)? Would that putative change produce concomitant changes in time spatialization and temporal asymmetries? We set to answer these questions empirically.

Throughout the Introduction, I showed that the experience of moving forward leads people to think spatially about time (which is reflected in the TIME IS SPACE conceptual metaphor) and this, in turn, could produce future-oriented asymmetries in time spatialization (placing the future in front), in perceived distance (feeling the future closer than the past), self-continuity (feeling a greater continuity with the future-self than the past-self), time discounting (giving a greater economic valuation to events in the future

than in the past), and temporal depth (having a longer temporal horizon into the future than into the past). Then I showed that culture can be a factor focusing our attention on either the future or the past through fostering progressive versus traditional cultural values. Moreover, I also discussed how people's temporal focus (i.e. their balance of attention to the future versus the past) can affect time conceptualization through the conceptual metaphor ATTENDING IS SEEING. Thus, in past-oriented cultures there might be a past-in-front mapping as well as past-oriented asymmetries. Finally, I showed that religious and secular coping strategies in the face of social crises can shift people's temporal focus to the past or the future, respectively, which could also have wide repercussions on the different dimensions of temporal thought.

This background raises many questions. Do cultures really differ in temporal focus? If so, does temporal focus covary with temporal asymmetries in time spatialization, time distance, self-continuity, time discounting, and temporal depth? In such case, does past focus imply past asymmetries and future focus future asymmetries? And finally, could a modern social crisis scenario, such as the arrival of the Covid-19 pandemic, change temporal focus and its repercussions on other dimensions of temporal thought? In this dissertation, we addressed these questions comparing samples of people from different cultures and religions in a series of temporal dimensions that let us assess how people think about the relationship between the past and the future. In the following chapter ("Overview of aims and research") I described these temporal dimensions and the tasks that are used to measure them, describe our cross-cultural and inter-religious approach, and summarize the doctoral dissertation research questions and goals.



CHAPTER II: OVERVIEW OF AIMS AND RESEARCH

CHAPTER II OVERVIEW OF AIMS AND RESEARCH

The overarching aim of the present dissertation was to study the role of temporal focus on the asymmetry between past and future in temporal spatialization as well as on other four dimensions of the human conceptualization of time: time distance, self-continuity, time discounting, and temporal depth across cultures and religions. We used tasks and questionnaires measuring all these dimensions referring to both past and future in samples of participants from eight cultures from West, Middle East, and Far East countries (American, Spanish, Serbian, Bosnian, Bosnian, Croatian, Moroccan, Turkish, and Chinese) who vary in their religious affiliation or position (mainly Christians, Muslims, and non-believers).

Furthermore, during the course of the dissertation we took the opportunity offered by the sudden arrival of the Covid-19 pandemic to study whether or not the social crisis it produced could affect people's religiosity and temporal focus, and whether or not this also affected temporal asymmetries on the other studied temporal dimensions. To do so we collected again samples during the pandemic in the same set of cultures that had been assessed before the pandemic, using the same tasks together with questions that measured the psychological impact of the pandemic.

All together, we attempted to study whether or not temporal focus and religiosity vary across cultures and (at least one) social crises and whether those variations are associated to asymmetries toward the past or the future. If this were so, we would have found evidence for the use of an alternative conceptual metaphor, ATTENDED IS SEEING, in time conceptualization. Against the implication of universality that follows from the TIME IS SPACE conceptual metaphor, born from the universal experience of moving forward, we would have shown that attentional factors that vary over individuals, social situations, and cultures, modulate temporal thought.

Importantly, with the dataset that we collected, another major issue can be addressed: the role of temporal focus and religiosity on the *global magnitude* of temporal dimensions across cultures and religions, and their possible change by the pandemic social crisis. In this case, we would not be examining the existence of temporal asymmetry (comparing the magnitude of responses toward the past versus the future) in thought, but whether or not the global (i.e., averaging past and future) distance/continuity/discount/depth perceived by people from future-oriented and less religious cultures is greater or smaller than that of people from past-oriented and more

56

religious cultures. In the present dissertation, we also show preliminary results of ongoing studies we are conducting to address this other main subject.

Finally, after having studied the role of temporal focus and religiosity across cultures on the temporal variables addressed, we studied the role of religiosity itself on all dimensions related to time asymmetry and global magnitude and in the samples collected both before and during the pandemic. The variables used, the cross-culture and cross-religion comparison approach, and the specific aims of the doctoral thesis are developed below.

Defining variables

How do we think about time has always been a central question, so there is an enormous amount of relevant research from diverse fields such as psychology (e.g., Fraisse, 1963; McGrath & Kelly, 1986), philosophy (e.g., James, 1890; McTaggart, 1908; see also Bardon, 2013; Callender, 2011; Gale, 2016), or anthropology (e.g., Gell, 2021; Munn, 1992). In the present dissertation we primarily studied how the attention we pay to the past and the future (using two measures of temporal focus as well as religiosity as predictor variables) is related to the asymmetry in time spatialization as well as in temporal distance, self-continuity, time discounting, and temporal depth (the predicted variables) over cultures and religions in both normal circumstances and during the social crisis of the COVID-19 pandemic crisis. This section contextualizes the predictor and predicted variables.

Predictor variables: The attention paid to the past and the future

There are several names used in psychology to refer to the attention to and evaluation of past and future (e.g., time attitude, temporal orientation, or time perception; see Hulbert & Lens, 1988). The umbrella term would be *time perspective* (Lewin, 1951) which in its broadest sense is understood as people's views of time regarding the past and the future. Among all these dimensions, *temporal focus* is the extent to which people devote their attention to the past, present, and future (Shipp et al., 2009). Temporal focus may be related, among other things, to cultural values about the past (such as tradition) or the future (progress) as shown in the Introduction. So conceived, we will call this construct

CHAPTER II OVERVIEW OF AIMS AND RESEARCH

value temporal focus, and it is the predictor of central interest in this doctoral dissertation. In the previous literature, there is another kind of temporal focus that does not refers to cultural values, but to the attention that people pay to one's own past or future, which we here term *personal temporal focus*. We also used this measure as a complement to the value temporal focus.

We studied the people's temporal foci between cultures and religions as well as through the pandemic crisis. Since religiosity is positively associated with traditional values and negatively associated with progressive values (Saroglou et al., 2003; Schwartz & Huismans, 1995), we added religiosity among the predictors considered in the present dissertation. Finally, we also added a questionnaire on the psychological impact of the pandemic, in order to study its relationship with the other measures of the study. These four predictors are described in detail below.

Value temporal focus

According to Schwartz (1992), cultural values are concepts or beliefs about desirable behaviors or states that go beyond specific situations, guide the selection or evaluation of behaviors and events, and are ordered according to a specific hierarchical importance. They are ways in which societies deal with their most basic problems to survive and which differentiate some cultures from others (see Hofstede, 2001; Inglehart & Welzel, 2005; Parsons, 1951; Schwartz, 2006). There are different cultural values as they express different motivational goals and societal concerns. Among them, Kluckhohn and Strodtbeck (1961) argued in their Value Orientation Theory that orientation to the past, present, or future is one of a limited number of universal problems to which all human societies must answer.

Each society positions itself regarding the past and the future in a different way (Brislin & Kim, 2003). Inglehart and Baker (2000) showed that one of the most important issues that differentiate one culture from another is traditionalism: the orientation to preservation versus openness to change and modernization. Thus, cultural temporal values related to the past (traditionalism) versus the future (progressivism) differentiate one society from another and modulate the attention paid to the past and the future at the cultural level. This may, in turn, create habits of thought that stably modulate the attention given to the past and future in individuals of each culture. We called this construct *value temporal focus* to distinguish it from the attention paid to the personal past and future.

There is extensive literature on temporal values across cultures. For example, Kluckhohn and Strodtbeck (1961) included time orientation as one of the four fundamental value orientations of different cultures; Tan and McCullough (1985; see also Hsu, 1948) developed a scale of traditional value orientations; Ko and Gentry (1991) offered a series of time orientation measures for its use in cross-cultural research; and Hofstede (2001) studied temporal cultural values, among others, in 40 countries. However, their scales and questionnaires did not focus exclusively on measuring attention to the values related to the past (tradition) versus the future (progressivism) but on other aspects of our time conceptualization. The Temporal Focus Questionnaire (TFQ) created by de la Fuente et al. (2014) does address this issue and it is the main measure of value temporal focus that we used in the studies of the present dissertation (see Chapters III, IV, and, V for a description of this questionnaire).

Personal temporal focus

Temporal focus has also been used in previous literature to refer to the balance of attention paid to the personal past, present, and future (e.g., Frank 1939; Lewin 1942; Sircova et al., 2014). It has been shown that this kind of temporal focus, which we will call *personal temporal focus*, has cognitive, emotional, and behavioral consequences (Germano & Brenlla, 2022). Previous studies have tended to consider these two kinds of temporal focus, value and personal, as two ways to measure the same construct (i.e., the amount of attention paid to the past versus the future, see Shipp et al., 2009, and de la Fuente et al., 2014). However, this is an empirical question (see a broader discussion of this issue in Chapter V and VI).

Although the attention paid to one's past and future stems from individual differences and may have to do with personality patterns (Germano & Brenlla, 2022), it may also vary across cultures (e.g., Sircova et al., 2007) since it is learned individually but manifests itself collectively (Zimbardo & Boyd, 2008). In addition, the attention paid to one's past and future might be related to cultural values. For example, people from countries with more progressive cultural values could also be more oriented to their own future than to the past. This is also an empirical question. To the best of our knowledge, the relationship between both kinds of temporal foci has not been studied so far.

Extant research uses several different instruments for measuring temporal focus over the personal life (e.g., Bond & Feather, 1988; Cottle, 1976; Rappaport, 1990).

CHAPTER II OVERVIEW OF AIMS AND RESEARCH

Among them, the two most popular measures are the Zimbardo Time Perspective Inventory (ZTPI; Zimbardo & Boyd, 1999) and the Temporal Focus Scale (TFS; Shipp et al., 2009). The ZTPI measures five temporal dimensions: past negative, past positive, present fatalistic, present hedonistic, and future; while the TFS measures three dimensions: attention paid to the personal past, present, and future. Thus, the ZTPI conflates time and emotional valence whereas the TFS is a purely cognitive measure (Shipp et al., 2009). We used the TFS to measure temporal focus because it had been used in some prior studies on time spatialization on the assumption that it taps on the same dimension as de la Fuente et al., (2014)'s measure of value temporal focus (e.g., Li & Cao, 2018a; 2018b; 2019). Thus, we will be able to assess to what extent the two measures index the same kind of underlying temporal dimension (see Chapter V for a broaden description of this measure).

Religiosity

Religiosity refers to the degree to which people adhere to their religious values, beliefs, and practices and uses them in daily life (Shukor & Jamal, 2013). It could play an important role in value temporal focus. Religious people tend to favor values that promote the conservation of social and individual order (where tradition is found) and, conversely, dislike values that promote openness to change and autonomy (which are related to progress; Schwartz, 1999). Thus, it is to be expected that religiosity also maintains a relationship with temporal thought. Moreover, changes in religiosity could go hand in hand with changes in the attention given to tradition versus progress. Religious coping proposals (Ano & Vasconcelles, 2005) suggest that during social crises, such as the COVID-19 pandemic, people may increase their religiosity to cope with the situation, which could imply having a more traditional focus (as apparently happened to the Romans after the battle of Actium). It could be, on the contrary, that people adopt a secular coping strategy, and rely on the values of progress to overcome the critical situation, focusing more on the future and decreasing their traditionalism and religiosity. Thus, studying religiosity, both in normal contexts as well as during social crises, could be useful to understand why and how people's temporal value focus changes.

Among the various scales that are available to measure religiosity (Egbert et al., 2004; Hill & Hood, 1999), we used the one developed by Cohen et al. (2003) because it

is a scale that captures the main dimensions of religiosity: religious belief, practice, and knowledge (see Chapter IV for a more detailed description of this questionnaire).

COVID-19 psychological impact

We created our own questionnaire on the psychological impact of social crises generated by COVID-19 since none was available in the literature when we used it. Our questionnaire resulted in an overall measure that could be divided into two components: one on the psychological concern related to the social situation and another on the psychological impact of the situation for the person (see a description of the questionnaire and its properties in Chapter IV).

Predicted variables: The perceived temporal asymmetry

Time spatialization

Thinking about time in terms of space is known as time spatialization. Past, present, and future are temporal concepts that tend to be spatialized as occupying different locations on spatial axes (e.g., Bonato et al., 2012; Núñez & Cooperrider, 2013). Of the three axes on which this association can be made (the vertical, horizontal, and sagittal axes), in this dissertation we studied the sagittal axis. Critically, we studied whether the subject tends to represent the future or the past as located in front or behind. As discussed in the Introduction, both the bodily experience of walking forward and a future temporal focus can generate a tendency to place the future in front of us. However, spatiotemporal mappings can be modulated by attentional processes that can be driven by cultural, social, and task context (e.g., Boroditsky, 2001; Casasanto, 2008; Casasanto & Bottini, 2014; Santiago et al., 2011; Torralbo et al., 2006). The Temporal Focus Hypothesis predicts that people who pay more attention to the past than to the future will tend to place the past in front (de la Fuente et al., 2014). We studied time spatialization using the Temporal Diagram Task, a non-linguistic task developed by de la Fuente et al. (2014; adapted from Casasanto, 2009; see the materials section in Chapters III and IV for a more detailed description of this task).

Time distance

Psychological time distance refers to the *subjective* distance at which past and future events are perceived, which may differ somewhat from the objective temporal distance at

CHAPTER II OVERVIEW OF AIMS AND RESEARCH

which they are located). The main finding regarding psychological distance to events located in the past versus the future is the Temporal Doppler Effect (Caruso et al., 2013): future events are perceived as closer to the present than past events at the same objective distance, which is born from the experience of movement, as shown in the Introduction.

Aksentijevic and Treider (2016) tested the hypothesis that motion (both real and imagined and from both a time-moving and ego-moving perspective) is what shortens the distance to the future (and widens it to the past). To do this, they devised a paradigm in which there was actual sagittal movement, either forwards (which would presumably make people feel that the future is getting closer) or backward (which would presumably make people feel that the future is getting farther and farther away) and asked their participants to judge the temporal distance to future and past events. Their results showed that Doppler-like distortion was only observed in conditions in which the distance between the participant and a frontal target increased in both forms of temporal perspective: i.e., when the participant (in these cases, the future was felt further and further away). However, it did not occur in the natural condition in which the subject walks forward nor when the future event is approaching the subject (when the participant should feel that the distance to the future is shortening, according to the TDE). These results present a challenge to the TDE.

On the other hand, Construal Level Theory suggests why we could perceive asymmetry in subjective temporal distance regardless of how we move. Instead, this account is linked to attention: greater attention may lead to the building of more detailed (more concrete) mental simulations of non-present events, and events more concretely construed are perceived as closer to the present. If this is so, people who are futurefocused should construe future events more concretely and therefore feel them closer to the present, just the opposite of past-focused people (see the Introduction).

All in all, more research is needed to test whether or not there is indeed a future asymmetry in temporal distance (a TDE) and whether it arises from the experiences of moving forward or from the attentional balance between future and past. We address these issues in this dissertation. To measure temporal distance we used the Temporal Distance Task developed by Caruso et al. (2013, see the materials section in Chapter V for an

explanation of the task), which, unlike other tasks, it has both a future and a past version and is designed to specifically measure past-future asymmetry.

Self-continuity

Self-continuity is the subjective sense of similarity of the self over time (past, present, and future; see Sedikides et al., 2022, for a recent review). Thinking according to a future asymmetry in self-continuity implies feeling more continuity with the future self than with the past self and the opposite would occur when thinking according to a past asymmetry in self-continuity.

Previous studies offered mixed results on the very existence of this temporal asymmetry: some studies show future asymmetry (Guo & Spina, 2019; Quoidbach et al., 2013; Rutt & Löckenhoff, 2016); others past asymmetry (Ji et al., 2019) and others symmetry between past and future (Guo & Spina, 2019; Molouki et al., 2019; and Rutt & Löckenhoff, 2016). In addition, while some studies have shown cross-cultural differences in perceived global self-continuity (Ji et al., 2019), there has been virtually no study focusing on the cross-cultural variation in self-continuity *asymmetry* (the perceived future-continuity versus past-continuity) and its relationship to temporal focus. We addressed these issues in the present dissertation, using the Self-continuity Scale by Ersner-Hershfield et al. (2009) for the future version, as well as its past version developed by Rutt and Lóckenhoff (2016; see the materials section in Chapter V for an explanation of this task).

Time discounting

Time discounting is the tendency to reduce the subjective value of a reward as the moment of delivery of the reward is farther in the future or the past. There is an extensive literature on time discounting into the future (see Frederick et al., 2002, for a review) but very little into the past (see Bickel et al., 2008; Molouki et al., 2019; Pope et al., 2019; and Stieg & Dixon, 2007, for exceptions) and the relationship between temporal focus and asymmetry in time discounting remains unclear. To the best of our knowledge, only one study investigated this topic (Guo et al., 2012), although they did not use a standard time discounting task. They observed that future-focused individuals valued more a reward in the future than in the past and the opposite occurred to past-focused people. We studied the asymmetry of time discounting and its relationship with temporal focus. To do so, we used the Time Discounting Scale developed by Kirby and Maraković (1996), which is a

classic measure widely used to study future discounting (Frederick et al., 2002), and adapted the task to refer to past monetary events (see the materials and methods section at Chapter V for a description of the task).

Temporal depth

Temporal depth refers to how much into the past and the future people typically consider when contemplating past and future scenarios (Bluedorn, 2002). Time depth, also called time horizons, have often been studied in the field of business and management and are used to understand people's strategic orientation (Das, 1987; Laverty, 1996; Marginson & McAulay, 2008; Souder & Bromiley, 2012). There are also studies comparing temporal depth (but not asymmetry) across cultures (e.g., Hofstede, 1980). Bluedorn (2002) showed that people from more traditional cultures have deeper time horizons (into both the past and the future). He also showed that people's general depth into the future is longer than into the past (i.e., that there is a future asymmetry in temporal depth). Can temporal focus affect the asymmetry in temporal depth? To address this question, we used a slight adaptation of the task developed by Bluedorn (2002; see chapter V, for a broader explanation of the task).

Comparing cultures and religions

Most studies of human psychology come from Western, Educated, Industrialized, Rich, and Democratic cultures, participants, and institutions (Henrich et al., 2010; Henrich, 2020). As its acronym shows, WEIRD societies are not representative of the global population. On the contrary, they are unusual in many ways. Thus, most psychology studies are not representative of the population worldwide. To establish both universal patterns and cross-cultural differences it is necessary to sample also from other cultures (Boyd, 2017; Gelfand, 2019; Henrich, 2016). Unfortunately, this situation has not changed much since Henrich et al. (2010) called attention to it. Newson et al. (2018) analyzed academic articles from six leading psychology journals and revealed a significantly lower but still very high percentage of studies from European and English-speaking nations (92%), compared to a decade ago (95%). Thus, psychology remains overwhelmingly WEIRD (see also Rad et al., 2018). Moreover, this bias is also affecting the field of psychology of religion, as it almost exclusively considers the Christian (or

Judeo-Christian) religion, which is the main religion of WEIRD societies (Newson et al., 2018).

Regarding time conceptualization, there are some cross-cultural and cross-religion studies, although we still find important limitations. First, most of the research has contrasted only North American and Chinese participants (see Gao, 2016, for a review), which are taken to represent West and East Asian cultures, respectively. There are very few studies considering samples from the Middle East or Africa. This also means that Islam, which is the main religion of several countries in these areas, is hardly considered despite being one of the main religions of the world (Smart, 1998). The literature suggests that people from some Middle Eastern countries are oriented to the past and traditional values, although modernization processes in the last decades might be changing their focus toward progress and the future (e.g., Aytaç & Rankin, 2004). Collecting participants from under-studied cultures is important to get a more general sense of how temporal focus affects how people think about time.

Second, findings on temporal focus and temporal asymmetries are mixed even in the most studied cultures: North Americans and Chinese (see Guo et al., 2012). The dominant view assumes that East Asians may be past-oriented (Doob, 1971; Kluckhohn & Strodtbeck, 1961; Ko & Gentry, 1991; Pitta et al. 1999; Spears et al. 2001; Yau, 1988) while North Americans are future-oriented (see Caruso et al. 2008, 2013; Graham, 1981; Kluckhohn and Strodtbeck, 1961; Spears et al. 2001; Van Boven & Ashworth, 2007). However, East Asians also show a future focus and focus more on future consequences (Brislin & Kim, 2003; Lee et al., 2011; Maddux & Yuki, 2006). These conflicting views could be explained, at least in part, because of the conflation of value and personal temporal focus. More research is needed to clarify this issue (Gao, 2016).

Third, cross-cultural differences in temporal conceptualization have been studied in several temporal dimensions, but almost exclusively regarding the future, and very little is known about potential asymmetries between past and future. Moreover, when both past and future have been considered, in the vast majority of cases the question of asymmetry has not been considered (see Sedikides et al., 2022; see also see previous sections as well as Table V.S1 in Chapter V for a summary). Thus, the previous literature has shown, for example, that compared to North Americans, East Asians focus more on the past and *also* on the future (e.g., Hofstede, 2001; Ji et al., 2009; Kim et al., 2012; Kluckhohn &

Strodtbeck, 1961; Ko & Gentry, 1991; Stevenson & Stigler, 1992; Wang & Conway, 2004), but whether there is a difference in temporal asymmetry is still unclear.

In this dissertation, we conducted five empirical studies in which we compared people from eight cultures from the West, Middle East, and Far East: American, Spanish, Serbian, Bosniak, Croatian —the last three from Bosnia-Herzegovina—, Moroccan, Turkish, and Chinese. The cultural groups were selected because we expected them to vary widely in their temporal focus and religiosity (Cohen et al, 2017; for the particular degree of religiosity and temporal focus of the cultures see Chapters III, IV, and V). We compared them in a battery of tests that assessed several temporal dimensions (time spatialization, time distance, self-continuity, time discounting, and temporal depth), all of them concerning both the past and the future. In addition to these samples, in Study 1 (Chapter III) we incorporated data from Vietnamese, Chinese, South African, and British samples that the authors of previous studies generously shared with us (Bylund et al., 2020; Gu et al., 2019; Li & Cao, 2017; Li et al., 2018).

We took nationality as a proxy for culture. We know that national boundaries do not necessarily correspond to cultural boundaries. However, countries show signs of cultural integration over time (Hofstede, 1990), for example, by sharing the same dominant language, educational system, institutional services, army, and political system, as well as mass media, markets, services, and national symbols such as sports teams, etc. (see Schwartz, 1999, for a defense of this approach). For this reason, the samples collected are representative of most of the country's shared background. There is, of course, the case of nations where the population is segmented into a number of strongly differentiated cultural groups, such as Bosnia-Herzegovina (Sells, 2003). This was one of the reasons that, in this country, we collected samples from its three main cultural groups: Serbs, Bosniaks, and Croats.

Finally, we conducted a last empirical study to examine the role of religion itself over all temporal dimensions addressed in the present dissertation (both before and during the pandemic). First, we compared Christians and Muslims in the global samples. As these samples varied in different factors (country, historical background, languages, institutions, levels of economic development, etc.) that could make it difficult to disentangle the specific role of religion in temporal conceptualization, we made a second approach, which was the second reason why we collected three groups in BosniaHerzegovina: to conduct a direct contrast between three different religions under conditions that control for several other factors that often vary between samples collected from different countries. Thus, we compared believers from the three main groups in Bosnia-Herzegovina: Serbs (who are mainly Orthodox Christians), Croats (mainly Catholic Christians), and Bosniaks (mainly Muslim; see Dušanić, 2007; Sells, 2003).

In short, we collected participants from around the world and from a variety of religions and religious attitudes. Note also that the studies were led from the University of Granada by Dr. Julio Santiago and myself, but conducted by an international research team including researchers and institutions from North America, Europe, the Middle East, and East Asia. In doing all this, we tried to overcome the WEIRD bias in terms of both cultures and religions of the collected samples as well as researcher cultural backgrounds.

Research goals

The main goal of this dissertation was to study the role of temporal focus and religiosity on time conceptualization across cultures and religions. We devoted most of our efforts to specifically studying the role of temporal focus on the <u>asymmetry</u> between past and future in several temporal dimensions. Whereas the TIME IS SPACE conceptual metaphor, based on the bodily experience of moving forward, motivates the universal tendency to spatialize the future as in front and may carry associated future asymmetries, the ATTENDED IS SEEING conceptual metaphor suggests that the balance of attention paid to the past versus the future across people, cultures, and social circumstances, will influence the extent to which the future or the past is situated ahead and whether the asymmetries are toward the future or the past. More specifically, we studied whether or not <u>temporal focus</u>: 1) varies between cultures around the world (Chapters III, and V) and together with religiosity as a result of the advent of the COVID-19 social crisis (Chapter IV and VI); 2) is related to <u>time spatialization</u> (Chapter III, IV, and VI) ; and 3) is related to other potential <u>asymmetries</u> in four temporal dimensions (distance, self-continuity, discounting, and depth; Chapter V and VI).

Moreover, we also report here preliminary analyses relevant to additional questions that can be answered with our data. Thus, we further studied whether or not temporal

CHAPTER II OVERVIEW OF AIMS AND RESEARCH

focus and religiosity are related to the global <u>magnitude</u> of perceived time distance, selfcontinuity, time discounting, and temporal depth (Chapter VII). Finally, we studied the effect of <u>religion itself</u> on each temporal dimension addressed in this dissertation (Chapter VIII). These goals are presented in detail below.

1. To explore how people's <u>temporal foci and religiosity</u> vary across cultures (American, Spanish, Serbian, Bosnian, Bosnian, Croatian, Moroccan, Turkish, and Chinese) and due to the Covid-19 social crisis. For this purpose, I proposed the following five sub-goals:

1.1. To explore value temporal focus (i.e., the attention given to past values, such as tradition, versus the future, such us progress) across cultures (Chapter III).

1.2. To explore whether or not and how value temporal focus and religiosity varied due to the arrival of the pandemic (Chapter IV).

1.3. To explore personal temporal focus (i.e., the attention given to their personal past versus future) across cultures (Chapter V).

1.4. To explore whether or not and how personal temporal focus varied due to the arrival of the pandemic (Chapter VI).

1.5. To explore the relationship between value temporal focus, personal temporal focus and religiosity across individuals and cultures and before and during the pandemic (Chapter VI).

2. To study the role of value temporal focus on <u>time spatialization</u> by testing the Temporal Focus Hypothesis (TFH). For this purpose, I proposed two sub-goals:

2.1. To test how general the TFH is across cultures (Chapters III and VI).

2.2. To test whether or not time spatialization changed according to variations in value temporal focus and religiosity due to the pandemic (Chapters IV and VI).

3. To study the influence of temporal focus on the past or future <u>asymmetry</u> in temporal distance, self-continuity, time discounting, and temporal depth. For this purpose, I proposed five sub-goals:

3.1. To explore if there is future asymmetry, past asymmetry, or symmetry in the dimensions of temporal distance, self-continuity, temporal discounting, and temporal depth across cultures (Chapter V).

3.2. To explore whether or not putative temporal asymmetries were predicted by either value temporal focus or personal temporal focus or both (Chapter V).

3.3. To explore whether or not the past and the future maintained a negative or positive relationship in our mind (Chapter V).

3.4. To explore whether or not the asymmetries of the different temporal dimensions were related to each other (Chapter V).

3.5. To explore the potential changes in temporal asymmetries and their relationship with the temporal focus due to the COVID-19 social crisis (Chapter VI).

4. To study the relationship of temporal foci and religiosity with the <u>global magnitude</u> of time distance, self-continuity, time discounting, and temporal depth across cultures. For this purpose, I proposed two sub-goals:

4.1. To study the relationship of temporal foci and religiosity with the global magnitude of time distance, self-continuity, time discounting, and temporal depth across cultures before the arrival of COVID-19 social crisis (Chapter VII).

4.2. To study whether or not the potential changes in temporal foci and religiosity due to the COVID-19 social crisis had an effect on the global magnitude of time distance, self-continuity, time discounting, and temporal depth across cultures (Chapter VII).

5. To explore the role of <u>religion itself</u> (comparing Christians and Muslims) on time conceptualization (Chapter VIII).

5.1. Study whether or not Christians and Muslims from the overall samples varied in their temporal conceptualization in the dimensions of temporal asymmetry and global magnitude in distance, self-continuity, time discounting, and temporal depth.

5.2. To study if believers from the three main groups in Bosnia-Herzegovina: Serbs (mainly Orthodox Christians), Croats (mainly Catholic Christians), and Bosniaks (mainly Muslim) varied in their temporal conceptualization in the dimensions of temporal asymmetry and global magnitude in distance, selfcontinuity, time discounting, and temporal depth.

Having addressed these objectives throughout the six main studies of the dissertation, in the General Discussion I discussed the results in relation to their theoretical framework and finally provided some general concluding remarks.



CHAPTER III: STUDY I
VALUE TEMPORAL FOCUS AND TIME SPATIALIZATION ACROSS CULTURES^{3,4,5}

³The content of this chapter has been published as:

Callizo-Romero, C., Tutnjević, S., Pandza, M., Ouellet, M., Kranjec, A., Ilić, S., Gu, Y., Göksun, T., Chahboun, S., Casasanto, D., & Santiago, J. (2020). Temporal focus and time spatialization across cultures. *Psychonomic Bulletin and Review*, 27(6), 1247–1258. https://doi.org/10.3758/s13423-020-01760-5

The names of some variables and terms have been slightly modified to maintain consistency throughout the dissertation.

⁴The publication with the content of this chapter has been awarded the prize to the best scientific contribution of 2020 by the SEPEX (Sociedad Española de Psicología Experimental) in the modality "Young SEPEX". <u>https://websepex.com/2021/09/28/premio-a-la-mejor-publicacion-cientifica-del-ano-2020-2/</u>

⁵Access a press release and a video report on this article through the following link: <u>https://canal.ugr.es/noticia/un-estudio-intercultural-senala-que-representamos-el-pasado-</u> <u>delante-o-detras-de-nosotros-en-funcion-de-la-importancia-que-le-otorguemos/</u>

Highlights (in relation to research goals):

- The cultures and subcultures collected (from 22 cultural groups) differed in their value temporal focus (in relation to research goal #1.1).

- The evidence supported the Temporal Focus Hypothesis. We also created a predictive model in which cultures and subcultures are placed on a single line relating time spatialization and value temporal focus (in relation to research goal #2.1).

Abstract

The Temporal Focus Hypothesis (TFH) proposes that whether the past or the future is conceptualized as being located in front depends on value temporal focus: the balance of attention paid to the past (tradition) and the future (progress). How general is the TFH, and to what extent can cultures and subcultures be placed on a single line relating time spatialization and value temporal focus in spite of stark differences in language, religion, history, and economic development? Data from 10 Western (sub) cultural groups (N = 1198,) were used to derive a linear model relating aggregated value temporal focus and proportion of future-in-front responses. This model then successfully fitted 10 independently collected (sub) cultural groups in China and Vietnam (N = 899). Further analysis of the whole data set (N = 2,097) showed that the group-level relation arose at the individual level and allowed precise quantification of its influence. Finally, in an effort to apply the model to all relevant published data sets, we included recent data from Britain and South Africa: The former, but not the latter, fitted the model well. Value temporal focus is a central factor that shapes how people around the world think of time in spatial terms.

Keywords: Cross-cultural differences, Time, Space, Temporal focus

Introduction

Janus, a popular personification of time in roman mythology (O'Keefe, 2021; Purcell, 2022)⁶, was represented with two faces, one in the front and the other in the back, one looking to the future and the other looking to the past (Wiseman, 2004). Why does it make sense to symbolize the past and future as being in front and behind a person? Moreover, why do we intuitively assume that the front eyes look to the future and the back eyes look to the past?

Conceptual metaphor theory (CMT; Lakoff & Johnson, 1980) proposes that to understand abstract concepts, we borrow structure from other concepts that we have more direct experience with, and therefore understand better. The idea that such conceptual metaphors ground our cognition has become a central part of the theoretical apparatus of embodied approaches to the mind (Barsalou, 2008, 2010), sparking a research boom in linguistics (Grady, 2010) and cognitive and social psychology (Landau et al., 2010; Williams et al., 2009).

Understanding time is strongly related to our experience of space. As we move forward, we reach our destination in front of us at a later time, and leave behind our original location at a prior moment. These correlations in experience motivate a conceptual metaphor that turns time itself into a line and the passing of time into the motion of ego from one point on that line, the past, located behind the person, to another point in the future, located in front. In a figure-ground reversal of this conceptual mapping, we can also think of future events as frontally approaching ego and receding into the past behind ego (Boroditsky, 2000; Clark, 1973; Lakoff & Johnson, 1980). The universality of these experiences and its intuitive relevance to time led Lakoff and Johnson (1980, 1999) to suggest that the linear metaphor of time is a cognitive universal. Indeed, a majority of languages in the world use spatial terms in ways that are consistent

⁶In the published paper with the content of this chapter (https://doi.org/10.3758/s13423-020-01760-5) we used the figure of the god Cronos (which is sometimes represented with two heads looking backwards and forwards) to exemplify how we spatialize time. Here I changed it to the figure of the god Janus to maintain consistency in this reference throughout the doctoral dissertation.

with this metaphor (Haspelmath, 1997; Radden, 2004), as when an English speaker says "in the weeks ahead of us."

Research, however, has made clear that time has a more complex relation with space in human thought. Firstly, experiences of motion may lead to alternative images of time. For example, in some absolute reference-frame languages, speakers map time along geographical axes: in Pormpuraawan languages, time flows from East to West (Boroditsky & Gaby, 2010), and for Yupno speakers, time flows upriver (Núñez et al., 2012). Moreover, all studied languages have the possibility of adopting a different perspective, one that does not depend on ego: If a sequence of temporal moments is conceived as if they were the wagons of a train, the initial (earlier) events are placed in the front, followed by the subsequent (later) events behind (Moore, 2006; Núñez et el., 2006). In some languages, such as Chinese, non-deictic expressions of this kind occur often (Yu, 2012). Secondly, some languages map the past in front and the future behind because they give special importance to the acquisition of knowledge through vision. For example, in Aymara (Núñez & Sweetser, 2006) and Vietnamese (Sullivan & Bui, 2016), the past is in front and the future behind because past events can be "seen" whereas future events are uncertain and therefore cannot be seen clearly. Finally, there are languages and cultures that do not seem to use linear representations of time at all, such as the Yucatec Maya (Le Guen & Balam, 2012) or the Amondawa (Sinha et al., 2011). Understanding time poses a profound challenge to the human mind and different cultures map temporal concepts in different ways onto different concrete experiences to deal with this problem (see Núñez & Cooperrider, 2013, for a review).

An even greater challenge for the CMT was the finding that several conceptual mappings can coexist simultaneously within the mind of an individual (Santiago et al., 2011). As mentioned above, Chinese speakers sometimes use a past-front/future-behind mapping, but more often they use either a vertical past-up/future-down mapping or a future-front/past-behind mapping (Boroditsky et al., 2011; Gu et al., 2019; Yu, 2012). Vietnamese speakers show both a past-front/future-behind mapping and a future-front/past-behind mappings in their language and gesture (Sullivan & Bui, 2016). Analyses of gesture and experimental tasks have shown that speakers of English can also use a past-front mapping when representing serially ordered sequences (Walker et al., 2017). Moreover, literate speakers of all languages also map time along a line that runs in the same direction in which they read and write their language (Bergen & Chan Lau,

2012; Ouellet et al., 2010; Santiago et al., 2007; Tversky et al., 1991). Thus, having more than one, and often several conceptual metaphors for time is not an exception. Santiago et al. (2011) proposed that the selection of the active mapping at any given time depends on a combination of attentional factors, task requirements, long-term entrenchment of habits, and coherence interactions within working memory.

De la Fuente et al. (2014) discovered a past-in-front spatial mapping of time in an unexpected population: Moroccans. In Darija, the local Arabic dialect in Morocco, deictic (ego-centered) linguistic expressions map the future in front and the past behind. However, when Moroccans were presented with the diagram shown in Fig. 1 and asked to place a future and a past event in one of the two boxes, either in front or behind the character, Moroccans preferred to place the past event in the front box. A control group of Spanish speakers (another language that uses only future-front/past-behind metaphors in deictic expressions) showed the expected preference to place the future event in the front box.

Fig. III.1





Why would Moroccans prefer to place the past in front? As the explanation could be neither in their sensorimotor experiences nor in language, de la Fuente et al. (2014) suggested a cultural cause. They proposed the Temporal Focus Hypothesis (TFH): When something is attended to, we usually orient eyes and body toward the object, which then comes to be placed in front of us. If the past is attended to more than the future, the past will tend to be conceptualized as in front. Cultures vary in their temporal values: the relative importance given to the past (tradition) versus the future (progress). Research based on the World Values Survey has found that the degree of traditionalism is one of the two fundamental dimensions that explain differences among cultures (Inglehart & Baker, 2000). Kluckhohn and Strodtbeck (1961) isolated five basic types of problems to be solved by each society. One of them was whether the temporal focus should be on the present, the past, or the future. Through extended practice, cultures may instill attentional habits in their members, and these may affect how they respond in the temporal diagram task.

As predicted by the TFH, de la Fuente et al. (2014) showed that Moroccans were relatively more focused on the past than were Spaniards, and more frequently placed the past in front. They also tested a group of Spaniards that was expected to have a greater focus on the past: Spanish elders. Older Spaniards showed a level of past focus that was intermediate between young Spaniards and Moroccans. Correspondingly, they placed the past in front more often than the young Spaniards and less often than the Moroccans. The predicted differences held across cultural and subcultural groups as well as at the individual level: Participants who gave higher relative importance to past versus future values also tended to place the past in front.

The goal of the present study was to test the generality of the TFH. Does the value temporal focus of individuals in cultures and subcultures that vary in many other respects reliably predict their preferred temporal spatialization? Can all cultures and subcultures be placed on a single line relating time spatialization and value temporal focus in spite of stark differences in language, religion, history, and economic development? To answer this question, we first assessed value temporal focus and time spatialization in seven cultural groups (N = 978) as part of a currently active research project across five countries: Spain, USA, Morocco, Turkey, and the Serb, Croat, and Bosniak parts of Bosnia-Herzegovina (B&H). Across these groups there are both differences and similarities in language, religion, history, and economic development. For example, both Moroccans and Turks share a common religion, but they differ in language, history, and socioeconomic status, but have very different cultural identities, strongly linked to religion: Serbs are Orthodox Christians, Croats are Catholic, and Bosniaks are Muslim (Sells, 2003). We widened this initial sample by adding the three groups assessed in the

original report by de la Fuente et al. (2014; N = 220): young Spaniards and Moroccans, and older Spaniards.

A first set of analyses focused on the group level. We aggregated value temporal focus and used it to predict the proportion of future-in-front responses in each group. The data showed a very clear linear relationship. The predictive ability of this initial grouplevel model was then tested by assessing how well it fitted a new set of 10 (sub) cultural groups from East Asia. The first eight Asian groups had been independently collected and already published by Dr. Heng Li and his collaborators. Li and Cao (2017; N = 563) compared pairwise six subcultural groups from China: students of history versus computer science; residents in a traditional neighborhood versus residents in modern apartments; and visitors to traditional art versus modern art exhibitions. These six groups shared culture, history, language, ethnicity, and religion, but varied in their interests, architectural context, and age. Li et al. (2018; N = 182) contrasted Vietnamese participants living in the North (Hanoi) versus living in the South (Ho Chi Minh City) of Vietnam. For historical reasons, Southern Vietnamese were expected to be more future focused, whereas Northern Vietnamese more past focused. The two groups were matched in language, ethnicity, religion, age, and many other factors. A ninth Chinese group of mostly university students was independently collected by Dr. Yan Gu before he joined our team (Gu et al., 2019; N = 59). Finally, as part of ongoing efforts to widen our crosscultural database, we collected an additional Chinese group (N = 96).

East Asian participants pose a strong challenge to the regression model obtained from the initial sample, as they differ profoundly from the initial groups in linguistic, social, cultural, and other important cognitive dimensions, such as individualismcollectivism and analytic-holistic style (Nisbett et al., 2001; Varnum et al., 2010). Moreover, there is evidence that both Chinese (Li, 2018; Yu, 2012) and Vietnamese people (Sullivan & Bui, 2016) show past-in-front mappings in language and gesture, while this has only been hinted at in the gestures, but not the language, of one group of the initial set (Moroccans; de la Fuente et al., 2014).

After testing the predictive power of the initial group-level regression model on these 10 new (sub) cultural groups, we used the whole data set (N = 2,097) to fit a logistic mixed model with random intercepts and slopes over groups. This model allowed us to assess how the linear relation observed at the group level arises from the individual choice

of placing the future in front or behind. It also allowed a precise estimation of the percentage of variance in individual responses in the time spatialization task that can be accounted for by the individuals' value temporal focus, as well as the variance between and within groups that remains unexplained.

Finally, during the preparation of this paper, a new study on the TFH was published (Bylund et al., 2020). Two conditions in this study used comparable methods to the other conditions included in the present analyses: British and South African university students (N = 140). Both can be considered Western cultures, although South African culture is more traditionally oriented than British culture (Bylund et al., 2020), so we did not expect to observe strong differences with the (sub)cultural groups included in our initial model. To provide a final test of the generalizability of the TFH, we assessed how well they fit the predictions of the model. Thus, all published data sets collected using the methods of de la Fuente et al. (2014) were included in the present study.

Methods

All analyses were carried out using R (R Core Team, 2018). The present study is part of a project aimed to assess time conceptualization across a wide range of cultures using various tasks. Here, we focus only on the question of whether it is possible to find a single linear relation between cultural value temporal focus and time spatialization that fits all (sub)cultural groups despite their wide differences in cultural dimensions and socioeconomic development. Findings regarding related questions will be reported separately.

Participants and data analysis

The data came in three waves of data collection. In the first wave (obtained in 2015), we collected data in Granada, Spain (N = 96), Pittsburgh, PA, USA (N = 64), and Banja Luka, in the Serb part of B&H (N = 96). In the second wave (2016), we collected additional data in Granada, Spain (N = 96), Pittsburgh, PA, USA (N = 96), and Banja Luka, B&H (N = 93), and added new samples from Istanbul, Turkey (N = 96), Mostar, in the Croat part of B&H (N = 100), and Tuzla, in the Bosniak part of B&H (N = 99). We also added two samples from Morocco, one from Tetouan (N = 96) and another from Tangier (N = 46). There were 978 participants in total: 256 in the first wave (169 females and 85 males, two nonresponses) and 722 in the second (451 females, 268 males, one other, two nonresponses). All participants were university students, mostly in their early 20s (M_{age}

= 21.6 years). All participants in the initial data set provided written informed consent for entry into the study according to the declaration of Helsinki principles. Names or any personal identification details were not collected. The study was approved by the Ethics Committees of the University of Granada, Koç University, and Duquesne University.

We defined our cultural groups according to the country of testing (Spain, Turkey, USA, and Morocco), with the exception of Bosnia-Herzegovina, where we distinguished three cultural groups: Banja-Luka (Serbs), Mostar (Croats), and Tuzla (Bosniaks). We are aware that not all participants at each site necessarily belong to the majority cultural group. However, by carefully and qualitatively considering their demographic information about cultural identity, native language, country of birth, parents' country of birth, and religion, we believe that most of the participants of each sample were members of the local majority culture. Thus, the cultural groups were relatively homogeneous by the operational definition of culture employed in the current study (raw data and scripts for descriptive analysis are available as Supplementary Material). We could have filtered out some participants to increase the homogeneity of the groups. However, the participants in prior published data sets were not filtered in this way, and we preferred to keep our data as comparable as possible to prior data. In fact, our approach runs against the present hypotheses by increasing the amount of random noise in the data (see also Inglehart & Baker, 2000, for data supporting the representativity of country as a unit of cross-cultural analysis).

The sample size of each group was established at 96 before the beginning of data collection. This number resulted from doubling the minimum number (48) necessary for a full run of the counterbalancing of all the tasks that the participants were going to perform during the session (which included several tasks not described here, some of which had several versions). This number was greater than the sample sizes collected in the only study using the present tasks published at the time of starting the second wave of data collection (de la Fuente et al., 2014). The actual number of participants that could be tested at each site and wave varied from the standard, usually because less, but in some occasions slightly more, participants volunteered for the study. To this initial data set, we added the data from Experiment 4 in de la Fuente et al.'s (2014) study (which are publicly available at http://osf.io/uh3in). In this study, there were two groups of university students: 55 Spanish ($M_{age} = 20.2$ years) and 93 Moroccan ($M_{age} = 28.6$ years) from

Granada and Tetouan, respectively. There were also 72 Spanish elders ($M_{age} = 73.6$ years). All in all, in this first phase of the study there were 1,198 participants.

We wanted to submit the regression model derived from this phase to the strongest possible test by using it to predict new samples from East Asian cultures, taking only a group-level approach in this first set of analyses. That is, we aggregated the individual value temporal focus values and obtained a group-level index, and regressed the grouplevel indexes over the proportion of future-in-front responses in each group. If the grouplevel-only model, based on only 10 data points, is able to successfully fit the new set of (sub)cultural groups, it will provide a very strong test of the predictive capability of the linear model derived from the initial sample.

The first set of new groups came from Studies 1, 2, and 3 in Li and Cao (2017). In their Experiment 1, there were 71 highly motivated Chinese graduate students of history or archaeology ($M_{age} = 21.9$ years) and 68 grad students of computer science or electronical engineering ($M_{age} = 22.5$ years). In Experiment 2, Chinese participants who had resided for 10–15 years in either the traditional neighborhood of Hutong (N = 102, $M_{\text{age}} = 31.8$ years) or modern apartment buildings in Beijing (N = 107, mean age not reported) were interviewed at their homes. In Experiment 3, the participants were visitors to the Ancient China Bronze Art Exhibition in the National Museum of China (N = 112, $M_{age} = 30.9$ years) or visitors to the Modern Painting Exhibition in the Hive Center for Contemporary Art in Beijing (N = 103, $M_{age} = 29.3$ years), all of whom had spent at least half an hour at the exhibition and reported being highly interested in it. The second set of new groups came from Li et al. (2018), who tested 90 participants in Ho Chi Minh City, South Vietnam ($M_{age} = 25.9$ years), and 92 participants in Hanoi, North Vietnam ($M_{age} =$ 23.8 years). All participants self-identified as ethnically Kinh and atheist, and the two groups were matched in education level and socioeconomic background. An additional Chinese group (N = 58) came from Experiment 3 of Gu et al. (2019). This experiment was designed to assess the effect of using spatial terms in the linguistic expressions that described a 3-D version of the temporal diagram task to the participants. We included only the data from valid participants in the control condition. This condition did not use any spatial terms and was the only condition directly comparable to all the other groups in the present study. Gu et al. (2019) reported a mean age of 29.99 years and mostly university-level education for the total sample of 206 participants in this experiment. Last, we collected a Chinese group in 2019 at Xuzhou (N = 96, $M_{age} = 19.3$ years, 96% atheists)

as part of a currently ongoing third wave of data collection (this is the only group of the third wave that has completed data collection until now).

After these initial group-level analyses, we used the overall data set (including all 2,097 participants in 20 groups) to fit a mixed (multilevel) model. The TFH proposes that the balance of attention devoted to past and future by the individual is the relevant factor for predicting his or her spatialization of time. That is, the TFH proposes that the relation between value temporal focus and time spatialization is a phenomenon that arises at the individual level, and not at the group (contextual) level. Moreover, a group-level-only regression model does not provide a realistic estimation of the percentage of variability that is accounted for by the predictors, as the model is computed on a reduced (aggregated) data set. To estimate variance components, we need to work from the individual responses. As those responses were binomial (a single response per participant, either future in front or future behind; see task description below), we computed a generalized mixed model assuming a binomial distribution with a logit link. The model predicts the probability of success (defined as future-in-front) as a function of the set of predictors, which in this case included only the value temporal focus of the individual. As random factors we included both group intercepts and the slopes of value temporal focus within each group. We will therefore decompose the total variability in the portions explainable by the fixed factor (individual value temporal focus) and the random factors (intercepts across groups and slopes of the value temporal focus effect within groups).

Finally, we included the two cultural groups in Bylund et al. (2020) that were comparable to the other groups in the present study: British (N = 70, $M_{age} = 22.2$ years) and South African (N = 70, $M_{age} = 20.8$ years) university students (both tested in English). We assessed how well these two groups were fitted by the initial model and recalculated the logistic mixed model and overall percentage variance estimation accounted by value temporal focus using the complete data set (N = 2,237).

Materials

In what follows we describe the methods of the initial data set, which is published here for the first time. The methods of the selected conditions from de la Fuente et al. (2014), Li and Cao (2017), Li et al. (2018), Gu et al. (2019), and Bylund et al. (2020) are described in those papers, and they were fully comparable to the ones described here. The tasks

were translated into the language of each sample. Back-translations confirmed translation equivalence between different language versions.

Temporal diagram task

The temporal diagram task was used to evaluate the location of the future and the past across the front-back spatial axis. It was conceived by Casasanto (2009) and adapted to the domain of time by de la Fuente et al. (2014). In this task, a simple schematic drawing is shown to the participant (see Fig. 1), while it is explained that "yesterday" the character depicted in the drawing went to "visit a friend who likes animals" and that "tomorrow he will go to visit another friend who likes plants." Participants are then asked to place the initial letter of the word "animal" in the box that best represents past events and the initial letter of the word for "plant" in the box that best represents future events. Four versions of the task were created to counterbalance the order of mention and combination of animals and plants, and future and past. The task thus consists of a single binomial trial. Placing the future event in the front box was coded as 1, in the back box as 0.

Temporal Focus Questionnaire

The Temporal Focus Questionnaire created by de la Fuente et al. (2014) measures cultural temporal values: how much the participant agrees with past-related values (e.g., "Young people need to preserve the values of their parents and grandparents") and future-related values (e.g., "Young people's values and beliefs must be different from those of their elders"). We slightly adapted de la Fuente et al.'s Temporal Focus (TF) Questionnaire by dropping one item to have the same number of items in the past and future categories. The scale contains 20 items: 10 items referred to past-related values, and 10 items referred to future-related values. No item refers to a value that is explicitly religious in nature. Each item is followed by a Likert scale ranging from 1 (total disagreement) to 5 (total agreement). In the first wave, the items were presented in random order. In the second wave, they were presented in strict alternating order, as in de la Fuente et al. (2014). The American version of the questionnaire in the first wave and the Turkish version in the second wave used 9-point scales. The responses to these versions were converted to the range 1–5. Past and future focus indexes were computed by averaging the ratings given to all the items in each category. Following de la Fuente et al. (2014), an overall TF Index was computed (TF index = [mean of future focused items – mean of past focused items] / [mean of future focused items + mean of past focused items]). For each participant, the TF Index expressed the balance between agreement with past-related and future-related values on a scale from -1 (*strong past focus*) to +1 (*strong future focus*). In the initial data set, the TF Questionnaire was found to have a Cronbach's alpha of 0.85 in the past scale and 0.63 in the future scale. Both values are within the range of acceptable values, taking into account that they come from a substantially large sample, although the future scale's alpha is at the lower end of that range. Using a Vietnamese translation of the TF Questionnaire, Li et al. (2018) observed an alpha of 0.81–0.83 for the past scale and 0.81–0.82 for the future scale in their two groups of participants (de la Fuente et al., 2014; Gu et al., 2019; Li & Cao, 2017, and Bylund et al., 2020, did not report the observed alpha at their studies).

Procedure

The tasks were completed in the facilities of the corresponding universities for each sample, using pen and paper. Participants received a leaflet with a battery of the different tasks and questionnaires. The leaflet started with the instructions and the consent form. The participants then filled a demographic questionnaire, followed by one of the four different versions of the temporal diagram task. This was followed by several additional tasks (e.g., temporal distance, temporal depth, time discounting, religiosity) from different studies (to be reported elsewhere). The penultimate test was always the TF Questionnaire. The instructions emphasized that participants were not to turn the page until the exercise on that page had been completed, or to look ahead or back to other pages. This warning was repeated at the bottom of each page.

Results

Group-level analyses

The TF Index had an approximately normal distribution overall, but it departed from normality in several (sub)cultural groups. Therefore, we took medians as indexes of central tendency within each group. We submitted the proportion of future-in-front responses in each group to a regression analysis using the median of the TF Index per group as predictor (see Table III.S1 in the Supplementary Material). The first analysis included the cultural groups of the initial data set (Spain, Morocco, Turkey, USA, Banja Luka, Mostar, and Tuzla) plus the (sub)cultural groups of Experiment 4 from de la Fuente et al. (2014; young Spaniard, old Spaniard, Moroccan). Visual inspection of the medians suggested the presence of a strong linear relation, which was supported statistically ($\beta =$

1.25, 95% CI [0.93, 1.57], $R^2 = .90$, F(1, 8) = 80.69, p < .001. Figure 2 (top) shows the best fit line, 95% confidence intervals, and 95% prediction intervals. We then added the 10 (sub)cultural groups from Li and Cao (2017), Li et al. (2018), Gu et al. (2019), and the Chinese group from our third wave of data collection to the chart. The model showed an impressive predictive capacity: As shown in Fig. 2 (bottom), only one of those groups (Chinese history students) felt outside the 95% prediction interval of the model (another one, Chinese visitors to the Modern Painting Exhibition, fell right on the limit; see also Fig. S2 in the Supplementary Material).

Fig. III.2

Linear Relation Between Median TF Index and the Proportion of Future-in-Front Responses.



Note. Top panel: Data from the 10 (sub)cultural groups of the initial data set and of de la Fuente et al. (2014). The solid line shows the best fitting linear model. The gray area shows the 95% confidence interval (the area where the mean prediction should fall 95% of the time). The dashed lines delimit the 95% prediction interval (the area where 95% of individual predictions should fall). Bottom panel: The same plot with the addition of the 10 (sub)cultural groups of Li and Cao (2017), Li et al. (2018), Gu et al. (2019), and the third wave Chinese group.

Individual-level analyses

The group-level analysis shows that the median TF of 10 Eastern (sub)cultural groups can be successfully predicted by a linear model computed from 10 Western and Middle East (sub)cultural groups. However, this analysis does not allow a realistic estimation of the percentage variance that is accounted for by the model, as this is computed over group aggregates and not individual responses. To get such estimation, a mixed (multilevel) model analysis is in order. Mixed models take into account variation between groups by assuming that group means are sampled randomly from a population of groups. They can also take into account variation within groups by assuming that the relation between predictors and response can also adopt different slopes in different groups. As mixed models need to compute a variance parameter among groups, a minimum number of groups is needed. There is debate about what is a reasonable lower limit for the number of groups, with current recommendations going from five or six (Bolker, 2020) to 40–50 (Sommet & Morselli, 2017). The complete data set, with 20 groups, would provide reasonably stable estimations.

Analyses were carried out in R using the lme4 package (Bates, et al., 2015) by fitting generalized linear mixed models using the binomial family and a logit link. Following advice in Sommet and Morselli (2017), we started by grand-mean centering and scaling the TF predictor (see Fig. S1 in the Supplementary Material for a directly comparable group-level analysis). We then fitted a null model (a model containing only the overall intercept; df = 1, AIC = 2,828.7) and compared its goodness of fit with a model including random intercepts per group (df = 2, AIC = 2,688.9). The goodness of fit improved significantly, $\chi^2(1) = 141.84$, p < .001. A third model added random slopes of value temporal focus within each group to the random term, which provided and additional increase in goodness of fit, df = 4, AIC = 2,495.2; $\chi^2(1) = 197.62$, p < .001. Finally, we compared this model to a model without any random term that included only TF as a fixed effect (df = 2, AIC = 2,611.8). The model with a random term provided a better fit, $\chi^2(1) = 120.54$, p < .001. Therefore, we kept both intercepts and slopes in the random term of the model and finally compared such a model with a model that added individual TF as a fixed effect (df = 5, AIC = 2,485.6). This improved fit significantly, $\chi^2(1) = 11.62, p < .001$. The final model revealed a substantial effect of TF on the probability of a future-in-front response, $\beta = 0.82$, OR = 2.27, 95% CI [1.49, 3.56]. Figure 3 shows probabilities estimated by the model and confidence intervals using only the individual TF as predictor and compares them to the observed group-level TF medians.

To quantify the proportion of variance in time spatialization accounted for by TF, we followed the delta approach developed by Nakagawa (Nakagawa et al., 2017; Nakagawa & Schielzeth, 2013) for generalized mixed models and implemented in the MuMin package (Bartoń, 2019). The full model (including both the fixed and random factors) explained 26.4% of total variance in individual binomial responses. The fixed effect of TF alone explained 11.9%, and therefore the random term (including intercepts and slopes) explained the remaining 14.5%.

Fig. III. 3

Estimated Probability of a Future-in-Front Response in the Whole data set as Predicted by the Individual TF.



Note. This model is without the contribution of the random term including random intercepts per group and random slopes of TF over groups. Observed TF medians per group are added. Unconditional confidence intervals were obtained using the ciTools package (Haman & Avery, 2019), under a parametric approach.

Addition of data from Bylund et al. (2020)

As a final test of the generalizability of the model derived from the initial data set plus de la Fuente et al.'s (2014) data, we included data from the British and South African groups in Experiment 1 of Bylund et al. (2020). Figure 4 adds these two groups to the contents of the bottom panel of Fig. 2 (see also Table III.S1 in the Supplementary Material for the full set of group-level data). As seen in Fig. 4, the British data are well within the prediction interval of the model, but the South African group falls clearly outside those limits and is very different from any other (sub)cultural group.

We then included Bylund's data to the data set, scaled and centered the TF Index, and recalculated the individual-level mixed-model analysis using all available data. The TF still had a clear and significant effect on the probability of producing a future-in-front response in the temporal diagram task, $\beta = 0.72$, OR = 2.05, 95% CI [1.37, 3.14]. The proportion of total variance explained by TF decreased to 9.1%, and the variance due to the random term increased to 15.9%.

Fig. III. 4.

Relationship of Value Temporal Focus to the Proportion of Future-in-front Using All the Samples.



Note. This is the bottom panel of Fig. 2 with the addition of the British and South African groups in Bylund et al. (2020, Experiment 1).

General discussion

In the present study we modeled the relation between value temporal focus and time spatialization in a wide sample of cultural and subcultural groups that includes all of the studies that conducted replications of de la Fuente et al.'s (2014) study, using close adaptations of the original methods. Value temporal focus as defined here is the balance of importance given to past (tradition) versus future (progress) values in a particular group, and it is measured through the Temporal Focus Questionnaire developed by de la Fuente et al. (2014). Time spatialization refers here specifically to the location of the past and the future along the front-back axis (in front or behind the person), measured with the temporal diagram task also proposed by de la Fuente et al. (2014). The selected groups varied widely in many ways (e.g., language, age, religion, socioeconomic development, or ethnicity). Does a single line describe the relation between value temporal focus and time spatialization across cultural and subcultural groups in spite of their stark differences? The Temporal Focus Hypothesis (de la Fuente et al., 2014) proposes that such a relation arises at the level of the individual, and therefore should generalize across contextual factors.

The first analysis was computed over group-aggregated indexes of value temporal focus in 10 Western and Middle East (sub)cultural groups (N = 1,199) and then used to predict 10 East Asian, independently collected groups (N = 899). All new groups but one fell within the 95% prediction interval of the initial model (see Fig. 2, bottom), a surprisingly high success rate given the small number of groups that led to the initial model, the extent of the differences among them, and with the groups used for testing. We then used the whole data set to fit a generalized linear mixed model at the individual level. This model showed that the linear relation observed at the group level arises from the individual-level relation between value temporal focus and the probability of choosing to place the future in front. Specifically, individual value temporal focus explained 11.9% of the total variance in the choice of location for future and past. Random variation in intercepts and slopes of value temporal focus over groups explained an additional 14.5% of total variance. In a final analysis, we included data from a study published during the preparation of this article that assessed two additional Western cultures: Great Britain and South Africa. British data were again within the prediction interval of the initial model, but South African data were not. After including these two groups in the individual-level analysis, value temporal focus remained a significant predictor of future-in-front responses, although its accounted variance decreased to 9.1% and random term variance increased to 15.9%.

The random term in the model includes variance that reflects systematic differences across and within groups. The fact that this term made a significant contribution to the overall mixed model suggests that there remains an important degree of heterogeneity both over group means (intercepts) and slopes that calls for the identification of moderating factors. Candidate moderators are any of the myriad variables that differ across cultural and subcultural groups (age, language, religion, etc.). It is possible that many of those variables do not have strong effects, and only their combined influence explains a significant part of random term variance. However, the search might reveal moderators of strong influence and wide applicability across cultural groups.

Do the current data offer any hint of such wide moderators? In other words, what is the expected range of applicability of the Temporal Focus Hypothesis across cultures? One advantage of the present model is that it provides clear 95% prediction intervals on which to test whether a new (sub)cultural group does challenge the model or not. Among the 22 relevant conditions published so far, only the South African group stands up as a clear exception to the expectations of the model. (Although the group of Chinese history students also falls outside of the 95% interval predicted by the initial model, all other seven Chinese groups do not. This makes us think that this deviation maybe due to withingroup noise.) Available data, therefore, suggest that having a frequent use of past-in-front mappings in language and/or gesture, as it occurs in Chinese and Vietnamese (Gu et al., 2019; Li, 2018; Sullivan & Bui, 2016), does not push cultural groups out of the boundaries of the group-level model. If Sullivan and Bui (2016) are correct in linking the Vietnamese pattern to a greater importance given to the acquisition of knowledge by sight, we would expect that the current model also encompasses Aymara groups (Núñez & Sweetser, 2006). We can also be confident that many other potential moderators such as age, language, religion and religiosity, socioeconomic level, individualism-collectivism, and analytic-holistic processing do not push a group outside of the boundaries of the grouplevel model.

Why does the South African group stand so far from the model's prediction limits? Bylund et al. (2020) suggest that because Afrikaner culture is "associated with the apartheid regime," it "may carry implicit negative connotations that preclude any

inclination to place it in front" (p. 180). Other groups in the current study may be said to come from a recent, troubled past, i.e., groups from B&H. While both B&H and South African groups have similar past temporal focus, cultural identities in the Balkans (Serbs, Bosniaks, and Croats) became reinforced after the Yugoslavian war. However, young Afrikaner South Africans may see themselves as actively developing ways to express a coherent cultural identity. Post-apartheid Afrikaners are still learning how to balance respect for Afrikaner culture, language, and traditions with feelings of shame over apartheid, while their future role in South African society remains significantly charged with both fear and optimism (Cloete, 1992; Fairbanks, 2017). We suggest this population's very recent, fraught and complex political trajectory may affect the balance of attention paid to the future versus the past, whether it is interpreted as a reluctance to "face the past," a desire to "put the past behind them," or an emphatic "view toward the future."

All in all, present findings show that individual value temporal focus is a chief factor explaining the positioning of many cultural and subcultural groups along the line that relates value temporal focus with time spatialization. The Temporal Focus Hypothesis (TFH) proposes that the underlying mechanism is related to Núñez and Sweetser's (2006) account of the past-in-front mapping observed in the Aymara. In the Aymara, the past is in front because it can be seen. Under the TFH, the past can be in front because it is attended to. Attention triggers eye, head, and body movements that serve to place the attended object in front of us, thus affording further exploration. Attention brings the past to the front so that we can see it.

But the past is not a physical object. How is it possible to place it in front of us? Santiago et al. (2012; see also Santiago et al., 2011), leaning heavily on Johnson-Laird's (1983) mental model theory, proposed a theory of the mechanisms that achieve this feat. Attentional mechanisms do not work directly on external reality, but on the contents of internal models of the situation. Using perceptual data, these models can reflect faithfully the external environment, but they can also be flexibly manipulated to represent alternative situations. All kinds of concepts, including abstract ones, when subjected to scrutiny in working memory, are represented by means of concrete elements of mental models. Imagine that a person is asked, "If we exchange the places of Mars and Venus, which one would be closer to the Sun?" To solve this problem, she may create a mental model containing one big dot on the left, standing for the Sun, and several smaller dots at

different distances to the right, standing for the planets of the solar system. She can then exchange the positions of the dots corresponding to Mars and Venus to find the solution. This example highlights several important points. First, mental models are always contemplated from a cognitive vantage point, a deictic origin, the "mind's eye." Second, the relevant elements of the mental model, those that are attended to, are brought to occupy the position in front of the mind's eye. Third, the model can contain both objects (Earth, Venus) and structural dimensions on which those objects are located (distance to the Sun). Fourth, the deictic origin can also be placed on a particular point of a structural dimension. If instead of the solar system we think of the events in a week, we can construe the model as if contemplating the whole time line (either horizontally or vertically) in front of us, without occupying any specific position on it (a nondeictic model). The events on the line are then located in their sequential order, from earlier to later. But we can also place the ego on the time line, at a point usually taken to mark the present, which lets us distinguish past from future events. In this mental model we contemplate only one side of the line, as we cannot be on the line looking simultaneously in both directions. Which side is in front of us depends on which side is being attended to (see Santiago et al., 2011, for a more detailed description of the theory).

Operations of mental model construction are affected by mental habits. These can be acquired in many ways (Casasanto, 2014). Language can instill habits of thought, for example, using a left-right continuum to represent political parties (van Elk et al., 2010) or thinking of pitch in terms of thickness (Dolscheid et al., 2013). They can also be established because of systematic sensorimotor experiences, as placing good things in the side of the dominant hand and bad things in the side of the nondominant hand (Casasanto, 2009). Interaction with cultural artifacts, such as written pages and books, calendars, and charts, can induce a tendency to represent time and numbers as flowing horizontally (Dehaene et al., 1993; Ouellet et al., 2010). Cultural values can also instill habits of mental model construction. By means of conventions, rules, norms, role models, and explicit instruction, cultures train their members on what is more and what is less important. Mental habits develop as to what should receive more attention. Thus, when we represent the ego as placed on the time line, these habits affect which pole (past or future) tends to occupy the front position in the model, forcing the other pole to be behind ego. This way of representing time is probably of a static nature in most cases, with past events sitting in front of us at different distances, as it seems to be the case for Aymara (Núñez &

Sweetser, 2006) and has been argued for many ancient languages (Graham, 2018), but it could also be animated with motion, with past events receding in front of us and the future approaching from behind (as it has been defended for Vietnamese by Sullivan & Bui, 2016, and for Toba by Klein, 1987). In any case, a default past-in-front conceptualization is also compatible with the use of alternative conceptualizations of time in different moments, as required by attentional and task demands, among other factors (Santiago et al., 2011). Janus may be looking at the past sometimes with his front face and sometimes with his rear face.

To conclude, the present study has revealed that the balance between temporal values that place importance on the past (tradition) and values that favor the future (progress) is a central factor in giving shape to the way that people around the world think of time in spatial terms. It has also suggested that this relation may be moderated by other factors, opening up a research program aimed at identifying them.

Acknowledgements and funding

The authors are very grateful to Drs. Heng Li and Emmanuel Bylund for sharing the raw data of their studies with us, and to Andrea Flumini, Catherine Guilbeau, Jose Isidro Martínez Cascales, Juan Manuel de la Fuente, Kagan Porsuk, Kai Chai, Marta Blanco, and Sofía Amaoui for their help. This research was supported by Grant No. PSI2015-67531-P from the Spanish Ministry of Economy and Competitivity to Julio Santiago (PI), Daniel Casasanto, Tilbe Göksun, Alexander Kranjec, Joseph Lavallee, Marc Ouellet, y Slavica Tutnjević, as well as by a predoctoral contract (BES-2016-076717) to Carmen Callizo-Romero.

Open practices statement. The materials used for data collection, the raw data collected for the present study, analysis scripts for the results reported here, and supplementary tables and high-quality figures are available at <u>https://osf.io/86mxd</u>.

Author contributions. J. Santiago developed the study concept. S. Tutnjević., M. Ouellet, A. Kranjec, T. Göksun, D. Casasanto, and J. Santiago designed the study. S. Tutnjević, M. Pandza, A. Kranjec, S. Ilić, Y. Gu, T. Göksun, S. Chahboun, and J. Santiago collected data. C. Callizo-Romero and J. Santiago analyzed the data and drafted the paper. All authors provided critical revisions to the paper and approved its final version.

Supplementary information

Tables

Table III.S1.

Median Value Temporal Focus Index and Proportion of Future-In-Front Responses in The Datasets of the Present Study.

Source	Group	Median TFindex	Proportion future -in-front
Initial dataset	Banja Luka	-0.070	0.603
Initial dataset	Morocco	-0.020	0.627
Initial dataset	Mostar	-0.044	0.55
Initial dataset	Spain	0.085	0.740
Initial dataset	Turkey	0.078	0.677
Initial dataset	Tuzla	-0.036	0.545
Initial dataset	USA	0	0.663
de la Fuente	Moroccan	-0.27	0.226
de la Fuente	old Spaniard	0	0.694
de la Fuente	young Spaniard	0.21	0.836
Li Cao	AncientCBAE	-0.145	0.384
Li Cao	Apartment	0.21	0.757
Li Cao	Computer	0.225	0.824
Li Cao	History	-0.15	0.254
Li Cao	HuTong	-0.17	0.392
Li Cao	ModernPE	0.14	0.66
Li Bui Cao	North Vietnam	-0.05	0.511
Li Bui Cao	South Vietnam	0.135	0.722
Gu Zheng Swerts	ChinaGZS	0.0384	0.603
Wave3	China	0.045	0.5
Bylund	British	0.087	0.829
Bylund	South African	-0.03	0.843

Figures

Figure III.S1

Relationship of Value Temporal Focus to the Proportion of Future-in-Front at the Group-Level



Note. As the individual-level analysis uses the standardized Value Temporal Focus Index and it is based on the whole dataset (with the exception of Bylund's data), Figure S1 shows a corresponding group-level analysis: the Value Temporal Focus Index was first standardized using the grand mean and standard deviation, then group medians and proportion of future-in-front responses were computed, and they were entered into a regression model that was then used to compute confidence (grey) and prediction (dashed) intervals.

Figure III.S2

Relationship of Value Temporal Focus to the Proportion of Future in Front using Only the Groups From the Initial Dataset Compared to the Model Derived From the Initial Dataset Plus the Groups From de la Fuente et al. (2014).



Note. As requested by one of the reviewers, we computed the first regression model using only the groups from the initial dataset (black line) and compared it to the model derived from the initial dataset plus the groups from de la Fuente et al. (2014; red line). As shown, both models differ only slightly. The grey area shows the confidence interval and the dashed lines show the predictions and the prediction interval from the former model. The quality of the prediction worsens (the interval becomes wider) as the points are further away from the interval that was used to compute the model



CHAPTER IV: STUDY II

DEUS OR MACHINA: THE COVID-19 PANDEMIC AND YOUNG ADULTS' RELIGIOSITY, TEMPORAL VALUES, AND TIME SPATIALIZATION ACROSS CULTURES⁷

⁷The content of this chapter ir a manuscript under review as:

Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022). *Deus or machina: The COVID-19 pandemic and young adults' religiosity, value temporal focus, and time spatialization across cultures*. [Manuscript under review]. Department of Experimental psychology, University of Granada.

Highlights (in relation to research goals):

- The pandemic could make young people from eight cultures less religious and more progress-oriented, which challenges theories of religious coping (in relation to research goal # 1.2).

- We found evidence supporting TFH: changes in value temporal focus and religiosity were committed with changes in time spatialization (in relation to research goal# 2.2).

Abstract

How did the COVID-19 pandemic influence young adults' religiosity and temporal thought? Across cultures with different religiosity and temporal values (Americans, Bosniaks, Chinese, Croats, Moroccans, Serbs, Spaniards, and Turks), Study 1 showed that during the first confinement period, young adults (N = 497, mean age = 20.96) were less religious, held stronger progressive (or future-related) values, weaker traditionalistic (or past-related) values, and placed the future in front to a greater extent than a matched sample collected before the pandemic. Study 2 (N = 893) showed that the greater the psychological impact of the pandemic, the lower the religiosity, the stronger the future bias in temporal values, and the tendency to locate the future in front. Challenging religious coping and comfort views, present results suggest that young people turned to progress rather than religion and tradition in order to face the pandemic situation.

Keywords: COVID-19 social situation, coping, culture, Temporal Focus Hypothesis, temporal values.

CHAPTER IV COVID-19, TEMPORAL FOCUS, AND TIME SPATIALIZATION

Introduction

The COVID-19 pandemic arrived *deus ex machina*, i.e., without warning and endowed with the power of changing everything (Britannica, 2020). Its sudden arrival created enormous insecurity and forced governments to implement social restrictions — like total lockdowns — of a magnitude unseen in a lifetime. Did the arrival of the pandemic and its associated social situation affect people's religiosity? Did it change the attention and importance people give to tradition versus progressivism (value temporal focus)? If so, how? On the one hand, and according to the religious coping and comfort proposals, people affected by a crisis might tend to seek psychological security in religion (Pargament, 1997; Park & Cohen, 1993; Sibley & Bulbulia, 2012). Because religiosity is positively correlated with traditional values and negatively correlated with progressive values (Saroglou et al., 2003; Schwartz & Huismans, 1995), any increase in religiosity during the pandemic would be expected to be accompanied by a greater past value temporal focus: greater attention and importance given to traditionalistic versus progressive values. Thus, religious coping and comfort views would predict an increase in religiosity and past-related values as a result of the advent of the pandemic.

Recent work on the relation between temporal values and how people represent the past and the future as located in space (time spatialization) allows us to make an additional prediction. de la Fuente et al. (2014) predicted and found that a past temporal focus in temporal values would increase the proportion of participants who place a past event in front of ego, and vice versa. Callizo-Romero et al. (2020) extended this finding across many different cultures. If young people after the advent of the pandemic were more religious and gave more importance to traditional than progressive values than before the pandemic, they should also be more likely to locate the past in front.

Different factors may, however, modulate how a crisis affects the religiosity and temporal values of the people who endure the crisis. A main one is the degree to which those people are already religious: turning to religion as a coping strategy is more natural in those who are religious (Ahmadi, 2006; Baldacchino & Draper, 2001; Norenzayan & Hansen, 2006; Zapata, 2018). Although some studies found overall increases in religiosity in the face of adversity (Sibley & Bulbulia, 2012), others observe this effect mainly (sometimes only) among the faithful (Norenzayan & Hansen, 2006). On the other hand, social crises could have the opposite effect on less religious people and societies: in them, the search for security could instead reinforce their confidence in the state (versus the
religion) as provider of security and solutions (Gill & Lundsgaarde, 2004), thereby promoting the overall secularization process that already affects many cultures in the world (Bruce & Voas, 2016; Norris & Inglehart, 2011). If this is so, we should expect the effect of the COVID-19 pandemic on religiosity, temporal values, and time spatialization to be moderated by the degree of religiosity of different cultures before the crisis.

An additional moderating factor is the extent to which the crisis threatens directly the life, health, and possessions of the individual. Those who are closer to illness and death show greater propensity to turn to religion (Norenzayan & Hansen, 2006; Zapata, 2018). During the COVID-19 pandemic, people who were more religious and had a family member infected with COVID-19 believed that their religiosity increased during the pandemic (Molteni et al., 2020), but the general population did not believe that their religiosity changed (Pew Research Center, 2020b). These moderating factors predict specific effects in young people: Young people are often less religious (Pew Research Center, 2018), less prone to religious coping during illness (Ahmadi & Ahmadi, 2015), more oriented to progressive future-related values (de la Fuente et al., 2020). Thus, it is possible that young people in the pandemic became less religious, more future-focused, and placed the future in front to a greater extent.

In the present work, we investigated whether and how the arrival of the pandemic and its associated social situation was related to changes in young people's religiosity, value temporal focus, and time spatialization in cultures varying widely in their religiosity and value temporal focus before the arrival of the pandemic (from the most religious to the least religious culture: Moroccans, Croats, Bosniaks, Serbs, Americans, Turks, Spaniards, and Chinese; these culture also vary in their value temporal focus, see Callizo-Romero et al., 2020). To do so, we collected data online during the period of COVID-19 regulations that were mainly implemented in spring and summer of 2020, during or closely after the first total lockdown. We used the same tasks from a data collection effort conducted before the pandemic to measure religiosity, value temporal focus, and timespatialization (among other dimensions not reported here; see the Methods section). In addition, we added questions to measure the personal impact of the pandemic. These included items about the degree of compliance with imposed social restrictions, the feelings of change in everyday life, the feelings of concern about the pandemic, and the emotional mood.

We analyzed the samples collected before and during the pandemic using two complementary approaches to respond to our research goals and hypotheses. We report here these two complementary approaches as Studies 1 and 2. In Study 1 we investigated whether there was a change in young people's religiosity, value temporal focus, and time spatialization when they were tested before versus during the pandemic. To do so, we matched participants collected before with participants collected during the pandemic in terms of culture, education, age, sex, and handedness and compared the two resulting subsamples. We had no specific a priori predictions for how religiosity and value temporal focus would change in young adults during the pandemic. If they increased, and if they increased more in cultures which were more religious before the pandemic, this would support the predictions by the religious coping and comfort models; if they decreased, this would support the expectation that young adults react differently to social crises (at least, to a crisis of this kind) than older adults. We framed the analyses from the position of the latter view, and therefore the hypotheses were that the subsample collected during the pandemic would be less religious (hypothesis 1), and more future-oriented and less past-oriented (hypothesis 2) than the subsample collected before the pandemic. We did have a specific prediction regarding how time spatialization should covary with any change in temporal values: an increase in future focus should occur together with a greater tendency to place the future in front, while a decrease should go with a reduction in this preference or even a reversal (a tendency to place the past in front). Therefore, hypothesis 3 was that the subsample collected during the pandemic would place the future in front to a greater extent than the subsample collected before the pandemic.

As any potential differences between the two subsamples in Study 1 could be due to factors other than the pandemic, in Study 2 we used the entire dataset of young participants collected during the pandemic (which was much larger in size), from whom we had also measured the psychological impact of the pandemic. In Study 2 we hypothesized that the greater the perceived psychological impact of the pandemic, the lower the religiosity (hypothesis 4), the greater the future focus (hypothesis 5) and the greater the tendency to place the future in front (hypothesis 6). We also explored whether the potential changes applied across the board or there were instead differences between cultures with different levels of religiosity and value temporal focus.

Study 1

Methods

Transparency and Openness

We hereby assert that we here report how we determined our sample size, the criteria for post-data collection exclusion of participants, and we indicate all the tasks performed by the participants. All materials, datasets, and computer code (script) with detailed explanatory comments for the statistical analyses (developed in R version 4.1.1; see R Core Team, 2021) of Study 1 and Study 2 are publicly available at Open Science Framework (<u>https://osf.io/htxck/?view_only=e09625af99e740be88e1f04a5fa13f4a</u>). The present work is fully reproducible using those materials. The studies reported here were not preregistered.

This work is part of a wider project (the COVID-19 Time Project) aimed to study the impact of the pandemic on different psychological temporal dimensions that had been previously studied by our research group. In the work reported hereby we studied the relation between the pandemic and religiosity, value temporal focus, and time spatialization. This work follows up on a previous study testing the Temporal Focus Hypothesis (Callizo-Romero et al., 2020) in which value temporal focus was shown to have an effect on temporal spatialization across cultures, and the possible effect of religiosity was called to be further investigated. Within the COVID-19 Time Project we also collected data to study the impact of the pandemic on the degree of asymmetry people psychologically perceive between the past and the future in other temporal tasks (selfcontinuity, temporal distance, time discounting, and temporal depth) and its relation to both value and personal temporal focus. The findings from this second research strand follow up on a different previous study (see Callizo-Romero et al., 2022 for a description and a link to download the materials used for the other temporal tasks), and will be reported separately. The project in which this study is framed was approved by the Ethics Committee of the University of Granada. The authors declare no competing interests.

Participants

As part of studies conducted before the pandemic (Callizo-Romero et al., 2020), data from 1075 participants were collected (702 females, 364 males, 1 other, 8 non answer). Most of the participants were young university students (*mean age* = 21.37 years old, range 15-63, 80 missing values). The samples were collected at seven different locations

using paper and pencil questionnaires throughout three different waves: 2015, 2016, and 2019. The Spanish sample was collected at the Faculty of Psychology, University of Granada, both in the first wave (N = 96) and the second wave (N = 96). The American sample was collected at the McAnulty College and Graduate School of Liberal Arts, Duquesne University, Pittsburgh, Pennsylvania, in the first wave (N = 64) and the second wave (N = 96). The Serbian, Croatian, and Bosnian samples were collected in Bosnia-Herzegovina. The Serbian sample was collected at the University of Banja Luka, in the first wave (N = 96) and the second wave (N = 94). The Croatian sample was collected at Mostar University (N = 99) and the Bosnian sample was collected at Tuzla University (N= 99) both in the second wave. The Moroccan group (N = 142) was tested at the Faculty of Arts, Abdelmalek Essaadi University, Tetouan (N = 96) in the second wave, and at the Faculty of Law, University of Tanger (N = 46) in the second wave. The Turkish group (N = 46)= 96) was tested at Koç University, Istanbul, in the second wave. Finally, the Chinese group (N = 96) was tested at the Jiangsu Normal University, Xuzhou, in the third wave (raw data and scripts for descriptive analysis regarding other demographic information as cultural identity, language, country of birth, socioeconomic status, etc., are available as Supplementary information).

We set out the target sample size in 96 participants from each culture since this was the double of the minimum number (48) required for a complete execution of the counterbalance of all the tasks that participants had to perform during the session (which included several tasks not described here, some of which had several versions, see Method section). Note that the sample size N=96 is greater than the minimum required (67 per group) to find a medium effect size (d = .5) with 80% power and an alpha = .05 for a comparison of means between two independent groups.

During the pandemic, we carried out a new data collection using an online survey. Most participants completed the study in exchange for academic credits. In addition, there were two raffles of \$50 among the participants. We collected a total sample of 893 young participants (684 females, 202 males, 7 other, *mean age* = 21.94 years old, range 18-28) from the eight previous cultures and who were living in their respective countries at that moment: Spaniards (N = 384), Americans (N = 84), Serbs (N = 80), Croats (N = 76), Bosniaks (N = 22), Moroccans (N = 45), Turks (N = 46), and Chinese (N = 156). In Spain they were collected between May 8th and 19th, 2020, while the country was in a total lockdown. The data from the other cultural groups were collected between July 8th and

July 24th, 2020, when most of the countries were in a period of strong social restrictions (in most cases a total lockdown) and China had just finished one of its successive periods of strict social restrictions (see Taylor, 2021, for a global timeline of the coronavirus pandemic during 2020). We set to collect as many participants as possible in each cultural group, aiming for a minimum of the same number of participants as in the pre-COVID-19 cultural groups, although several samples failed to reach this minimum. We stopped the sample collection despite not reaching the desired sample size in all cultures since we wanted the sample to be collected in the period of strong social restrictions and these were eased at the end of July in most places (see Taylor, 2021). No data were analyzed before data collection was stopped.

To compare the pre- and during-COVID-19 groups, we matched as many participants from before the pandemic as possible with participants collected during the pandemic. To do this, we made random pairings between the participants of those two time-periods who were equal in terms of culture, age, sex, education, and handedness (see Table IV.1), after excluding all participants who did not disclose any of the matching items. This rendered 497 participants in each testing period. Figure IV.S1 in Supplementary information shows the percentages of the religious positions in each culture both before and during de pandemic.

As the time spatialization task was presented at the beginning of the online survey, 106 participants in the COVID-19 group carried it out but then left the study before filling in the questionnaires measuring value temporal focus and religiosity. To maximize sample size in the time spatialization task we included these participants in the matching process. In particular, we added three matches from Chinese participants, 18 from Moroccans, nine from Croatians, and 17 from Serbs, obtaining a total of 544 participants in each testing period in this task. The details of this expanded sample of matchings are presented in the supplementary information (see Table IV.S1).

Participants	Matched	From	Samples	Collected	Before	and	During	the	COVID-19
Pandemic in	the Follow	ving Va	ariables: (Culture, Ed	ucation ^a	ⁱ , Age	e, Sex, an	d Ha	indedness

Culture ^b	Condition	Ν	M age	Female	Right handed
Moroccans	Pre	22	22.64	95%	100%
	During	22	22.86	86%	84%
Croats	Pre	48	21.48	92%	92%
	During	48	21.90	96%	96%
Bosniaks	Pre	21	22.48	86%	90%
	During	21	22.48	90%	100%
Serbs	Pre	63	21.56	73%	87%
	During	63	21.83	94%	89%
Americans	Pre	46	21.00	91%	96%
	During	46	21.00	91%	96%
Turks	Pre	35	22.23	70%	97%
	During	35	22.00	77%	89%
Spaniards	Pre	175	20.85	87%	91%
	During	175	20.86	87%	94%
Chinese	Pre	87	19.26	95%	99%
	During	87	19.41	98%	98%
TOTAL	Pre	497	21.10	82%	92%
	During	497	21.00	86%	94%

Note. Pre = sample collected before the pandemic; During = sample collected during the pandemic.

^aAll the matched participants were university students. ^bThe cultures appear ordered (from top to bottom) from the most to the least religious according to pre-pandemic data.

Materials

The tasks were translated into the language of each sample (Spanish, English, Chinese, Turkish, Arab, and Serbo-Croatian). Back-translation performed by bilingual

researchers confirmed translation equivalence between different language versions. The following tasks were used (see Callizo-Romero et al., 2022 for other materials used in the project but not reported in this study).

Temporal Diagram Task. This task was developed by de la Fuente et al. (2014) to evaluate the location of the future and the past along the (sagittal) front-back spatial axis. In this task, a simple schematic drawing is shown to the participant (see Figure IV.1) while they read a short story. The story explains that the character in the drawing (whose name was adapted to the local language) had yesterday visited a friend who likes animals and that tomorrow he will visit another friend who likes plants. In the paper and pencil pre-COVID-19 version, participants were asked to place the initial letter of the word animal (in their language) in the box that best represents past events, and the initial letter of the word *plant* (in their language) in the box that best represents future events. In the online version used during COVID-19, the participant was first asked to select the object (animal or plant) that corresponded to the box in front of the character and then choose the object (animal or plant) that corresponded to the box behind the character. Four versions of the task were created by counterbalancing the order that animals and plants, and future and past were mentioned in the story. Although the task consists of a single binomial test, it has been found to have high diagnostic value (de la Fuente et al., 2014; Callizo-Romero et al., 2020).

Figure IV.1

Image Used in the Temporal Diagram Task



Temporal Focus Questionnaire. We used the Temporal Focus Questionnaire that was created by de la Fuente et al. (2014) and slightly adapted by Callizo-Romero et al. (2020). It measures people's temporal focus as the balance of importance people give to pastrelated (traditional) versus future-related (progress) cultural values (Callizo-Romero et al., 2022, called this operationalization of temporal focus value temporal focus and showed that it can be dissociated from the personal temporal focus, the amount of attention and thought devoted to the personal past and future). The scale contains 20 items: 10 refer to past-related or traditional values (e.g., "For me, traditions and old customs are very important") and 10 refer to future-related or progressive values (e.g., "It is important to innovate and to adapt to changes"). Each item is followed by a scale from 1 (total disagreement) to 5 (total agreement). By mistake, the American version of the questionnaire in the first wave and the Turkish version in the second wave of the sample collected before the COVID-19 pandemic used 9-point scales. These responses were converted to values using a 1-5 range. The items were presented in a random order in the first wave and in a strict alternating order of past and future items in the second and fourth waves, as in de la Fuente et al. (2014). In the third wave we also used an alternating order, except for two items which exchanged places due to experimenter error. The McDonald's omega (ω) of the past and future items for the overall samples were, respectively: $\omega =$ 0.86 and $\omega = 0.73$ for the matched sample collected before the pandemic; and $\omega = 0.88$ and $\omega = 0.75$ for the matched sample collected during the pandemic (we used McDonald's Omega since it is a more realistic and reliable measure than Cronbach's alpha especially for the present data distributions, see Peters, 2018).

Religiosity Questionnaire. We used the Religiosity Questionnaire developed by Cohen and colleagues (2003), which consists of three independent scales evaluating participants' religious belief, practice, and knowledge. The belief scale asks about the degree of belief in six statements (such as "I believe in God") with responses on a scale ranging from 1 (*not at all*) to 5 (*absolutely no exception or doubt*). In this scale, there is an item about belief in reincarnation which was not introduced in the analysis because this belief is not part of the doctrine of most of the religions studied here. The practice scale asks about the importance of seven practices for the participant (e.g., "Attending religious services regularly") on a scale from 1 (*not important at all*) to 5 (*extremely important*). The knowledge scale asks about the participant's knowledge about three aspects of their religion (e.g., "The structure and content of religious services of your religion") on a scale

from 1 (*not at all*) to 5 (*fluently*). Due to technical error, the scales of the questionnaire used in the USA before the pandemic in the first wave and in Bosnia-Herzegovina in both the first and second waves ranged from zero to five (a six-points scale). These responses were converted to a 1-5 range. The McDonald's omega (ω) of the belief, practice, and knowledge scales, as well as the overall scale were, respectively: $\omega = 0.95$, $\omega = 0.93$, $\omega = 0.93$, and $\omega = 0.96$ for the matched sample collected before the pandemic; and $\omega = 0.95$, $\omega = 0.92$, $\omega = 0.95$ and $\omega = 0.97$ for the matched sample collected during the pandemic.

Procedure

Data collection before the COVID-19 pandemic were completed in the facilities of the corresponding universities for each sample, using paper and pencil. Participants received a leaflet with a battery containing the different tasks and questionnaires. The leaflet started with the instructions and the consent form. The participants then filled a demographic questionnaire, followed by one of the four different versions of the Temporal Diagram Task. This was followed by several additional tasks not used in the present study. The two final tests were the Temporal Focus Questionnaire and the Religiosity Questionnaire, always in this order. The instructions emphasized that participants should neither turn the page until the task on that page had been completed nor look forward or backward to other pages. This warning was repeated at the bottom of each page. The data from the Temporal Focus Questionnaire and the Temporal Diagram Task from the sample collected before COVID-19 were used as part of the wider analysis in Callizo-Romero et al. (2020), and the Temporal Focus Questionnaire and the intermediate tasks were reported in Callizo-Romero et al. (2022). In the present study we report for the first time the data from the Religiosity Questionnaire collected before the pandemic, and the data collected during the pandemic from all three tasks. We used the LimeSurvey platform for the online data collection during the pandemic. The three tasks here reported appeared in the same order as in the pre-COVID-19 sample. In addition, we included items on the psychological impact of the pandemic (described in Study 2) just after the socio-demographic information.

Data processing and analysis plan

The ratings of the past and future scales of the Temporal Focus Questionnaire were averaged per participant and combined to create the *Value Temporal Focus Index* following the formula proposed by de la Fuente et al. (2014): index = [mean of future items – mean of past items] / [mean of future items + mean of past items]. For each

participant, this index expressed the asymmetry between agreement with past-related (tradition) and future-related (progress) values on a scale from -1 (strong past focus) to +1 (strong future focus). Thus, positive scores indicated a future value focus and negative scores indicated a past value focus.

We also created three indexes by averaging the items of the three subscales from the Religiosity Questionnaire: belief, practice, and knowledge. We then computed a general index of religiosity (hereinafter the *Religiosity Index*) by averaging the indexes from the three subscales (which were strongly correlated to each other: $.54 < \tau b < .65$, *p* < .001 in all cases). Finally, in the Temporal Diagram Task, placing the future event in the front box was coded as 1 and in the back box as 0.

We used the following criteria for post-data collection exclusion of participants: Participants who left four or more items blank in either the Temporal Focus (N = 196) or the Religiosity (N = 210) Questionnaires, or who placed both the past and future event in the same box in the Temporal Diagram Task (N = 38), were filtered out before matching the samples collected before and during the pandemic.

The data from most of the samples did not follow a normal distribution in the value temporal focus index or the religiosity index. According to Shapiro-Wilk tests, the religiosity index was not normally distributed in any cultural group neither pre nor during COVID-19, and the value temporal focus index differed from a normal distribution in most groups except Moroccans, Serbs, and Bosniaks. In addition, the Lilliefors test showed deviations from normality in the overall samples (both collected pre and during COVID-19) in both value temporal focus index and the religiosity index. For this reason, we carried out non-parametric statistical analyses in this study.

In Study 1 we analyzed (by means of the Mann-whitney tests and chi-square test of independence) comparing the scores in the pre-COVID19 group versus the during COVID19 group in religiosity, value temporal focus, and time spatialization. The analyses are reported for: 1) the overall sample; 2) in each culture; and 3) when pooling participants from cultures that before the pandemic had future versus past temporal focus.

Results

Mann-Whitney comparisons for independent samples showed that participants during the pandemic (as compared to those assessed before) scored lower on religious belief, practice, and knowledge as well as in the overall Religiosity Index (in all cases p < .001).

They also agreed less with traditional values and more with progressive values, increasing scores on the Value Temporal Focus Index and indicating a greater future focus. Figure IV.2A shows the overall results from the matched samples, pooling all cultural groups together (Table IV.S2 in Supplementary materials shows the numeric results). The effect size of these differences ranged from medium to large (the rank biserial correlation, *rrb*, is the effect size associated with the Mann-Whitney test for independent samples; *rrb* of 0.1, 0.2, and 0.4 represent small, medium and large effect sizes, respectively; see McGrath, & Meyer, 2006).

Further analyses showed that the same differences could be observed in the same direction within most cultures, both in the Religiosity Index and in the Value Temporal Focus Index (see Figure IV.2B; see Tables IV.S3-IV.S11 in the Supplementary Materials for the numeric results of all indexes and subscales in each culture). However, because of small sample sizes in several groups (all but Spaniards, Serbs, and Chinese) the groupwise results should be taken with caution.

Effect Sizes Calculated by Rank Biserial Correlation From Comparing the Samples Collected During Versus Before COVID-19 in (A) the Whole Set of Subscales and Indexes From the Religiosity and Temporal Focus Questionnaires in the Overall Sample and (B) the Religiosity and Value Temporal Focus Indexes in Each Cultural Group



Note. VTF = Value Temporal Focus.

For the Mann-Whitney test, effect sizes are given by the rank-biserial correlation. *The error bars show the 95% confidence interval of the effect size. Statistically significant results are marked with asterisks: * p < .05, ** p < .01, *** p < .001. The cultures shown in figure IV.2B are ordered from the most to the least religious according to data collected before the pandemic.

Kendall's Tau correlations showed that the correlation between the Religiosity Index and the Value Temporal Focus Index (Figure IV.3) was statistically significant in both testing periods: before (N = 497), $\tau b = -.376$, p < .001, and during the pandemic (N = 497), $\tau b = -.349$, p < .001. According to Fisher's Z, the difference of those correlations in both testing periods was not statistically significant from each other, Z = .36, p = .72.

Correlations Between the Religiosity Index and the Value Temporal Focus Index in the Samples Collected Before and During the COVID-19 Pandemic



Note. The regression line and its standard error are shown for each testing period. The distribution density of each variable is shown in the margins.

The chi-square test of independence of the Temporal Diagram Task showed that people during the pandemic were more likely to locate the future in front than before the pandemic, $X^2 (1, N = 1086) = 8.07, p < .01, OR = 1.44\ 95\%\ CI = [1.12, 1.86]$. The analyses within cultures found this difference statistically significant only in Croats, $X^2 (1, N = 114) = 5.33, p < .05, OR = 2.47, 95\%\ CI = [1.14, 5.38]$, and Chinese, $X^2 (1, N = 180) = 5.93, p < .05, OR = 2.12, 95\%\ CI = [1.15, 3.89]$. Figure IV.4 shows the effect sizes (Odd Ratios) both within each culture and overall.

Effect Sizes (Odds Ratios) From Comparing the Proportion of Participants Who Place the Future in Front in the Samples Collected During Versus Before the COVID-19 Pandemic Both Within Each Culture and Overall



Note. Cultures appear ordered from left to right from the most to the least religious according to the sample collected before the pandemic. The result of all the samples pooled together is shown on the far right.

*The error bars show the 95% Confidence Interval. Statistically significant results are marked with asterisks: * p < .05, ** p < .01.

Finally, to clarify whether the change in religiosity, value temporal focus, and time spatialization took different courses in cultures that before the pandemic were more versus less religious, and more future-focused versus past-focused, we split the cultures into two groups based both on their religiosity and temporal value. To split cultures according to their degree of religiosity we compared each culture's level of religiosity to the value 3.3 which is the mean religiosity of the overall pre-pandemic sample (the Religiosity Questionnaire scale ranges from 1 to 5; see the results in Figure IV.S2 in the Supplementary Materials). This resulted in two clusters: on the one hand the most religiosity mean: Moroccans, Bosnians, Croats, and Serbs) and on the other hand, the least religious cultures (i.e., those whose religiosity was statistically lower than the global religiosity mean: Turks, Spaniards, and Chinese; Americans were not included in this contrast because their pre-pandemic religiosity level was not statistically different from 3.3; see Figure IV.S2). To split cultures according to their value temporal focus we pooled together, on the one hand, participants from cultures that placed more importance on

traditional values than on progressive ones (i.e., they had a Value Temporal Focus Index significantly lower than zero: Moroccans, Bosnians, Croats, and Serbs) and, on the other hand, participants from cultures that were more progressive than traditionalist before the pandemic (i.e., their Value Temporal Focus Index was significantly higher than zero: Spaniards, Chinese, and Turks; Americans were not included in this contrast because their Value Temporal Focus Index before the pandemic was not statistically different from zero; Figure IV.S3 in the Supplementary Materials shows the pre-pandemic temporal Value Temporal Focus index in each cultural group). As shown, the cluster of pastfocused cultures is the same as that of the most religious cultures (Moroccans, Bosnians, Croats, and Serbs) and the cluster of future-focused cultures is the same as that of the least religious cultures (Chinese, Spaniards, and Turks).

The contrast between the samples collected before versus during the pandemic in all three measures was always in the same direction in both the highly religious, past-focused cultures and the low religiosity future-focused cultures. It was significant in all cases with the only exception of the former set of cultures in the time spatialization measure (see Figure IV.5 and Tables IV.S12- IV.S15 in the Supplementary Materials for test results). The effect sizes did not differ significantly between the most religious (and future-focused) and the least religious (and past-focused) cultures in any measure (see Figure IV.5 and Tables IV.S15 in the Supplementary Materials). Thus, the changes observed in religiosity, temporal values, and time spatialization during the pandemic occurred to an equal extent in cultures that differed strongly in their prepandemic religiosity and temporal values.

Effect Sizes of the Religiosity and Value Temporal Focus Indexes (A); and the Proportion of Participants Who Place the Future in Front (B) When Comparing the Samples Collected During Versus Before the COVID-19 Pandemic in the Cultures That Before the Pandemic Were More religious and Past-Focused Versus Those That Were Less Religious and Future-Focused^a



Note. The effect sizes for the Religiosity and Value Temporal Focus Indexes are estimated by the Rank Biserial Correlation, and for the proportion of participants who place the future in front by the Odds Ratio.

The highly religious and past-oriented cultures (according to the overall sample collected before the pandemic) were Moroccans, Croats, Bosniaks, and Serbs. The low religious and future-oriented cultures were Chinese, Spaniards, and Turks (see Figure IV.S2 and IV.S3 in Supplementary information).

The *N*s show the total sample size in each index and group. Half of each sample size corresponds to the sample collected before the pandemic and the other half to the sample collected during the pandemic.

*The error bars show the 95% Confidence Interval of the effect size. Statistically significant results are marked with asterisks: *p < .05, *** p < .001.

Study 2

Methods

Participants

In Study 1 we used data from a sub-sample of 497 participants collected during the pandemic that was matched with the same number of participants collected before the pandemic. In Study 2 we used the complete sample of young participants (between 18 and 28 years old; *mean age* = 21.94) collected during the pandemic. As the study was run online, we asked the participants whether they considered themselves to belong to the culture of the place where they were located at the time of the study, and excluded those participants who answered negatively (N = 70), which left a total of 893 participants (684 females, 202 males, 7 other). Most of them (80%) were students, 1% was infected with COVID-19 when they answered the questionnaire, and 3% passed the first confinement in complete social isolation (unaccompanied). The participants were from the following cultures: Spaniards (N = 384), Chinese (N = 156), Turks (N = 46), Americans (N = 84), Moroccans (N = 45), Bosniaks (N = 22), Croats (N = 76), and Serbs (N = 80). Figure IV.S4 in Supplementary information shows the percentages of each religious position in each culture).

Materials and procedure

Study 2 analyzes all data collected during or closely after the first COVID-19 confinement. Therefore, the materials and procedure were as described in Study 1 for the COVID-19 group. The McDonald's omega (ω) for the overall sample in the Temporal Focus Questionnaire was $\omega = 0.88$ for the past-related items and $\omega = 0.76$ for the future-related items. The McDonald's omega (ω) for the overall sample in the Religiosity Questionnaire was $\omega = 0.94$ for the belief sub-scale; $\omega = 0.91$ for the practice sub-scale; $\omega = 0.95$ for the knowledge sub-scale; and $\omega = 0.97$ for the overall scale.

In Study 2 we also included seven items aimed at assessing the impact of the pandemic (hereinafter the *COVID-19 items*) shown in Table IV.2 (see also a principal component analysis of them in the next section).

The COVID-19 Items Assessing the Impact of the Pandemic and Correspond	ling	Social
Restriction Measures on the Life and Mind of the Participants		

Item name	Item
Strict	Rate how strictly have you followed confinement guidelines,
Compliance	where $1 = Not$ strictly; $5 = Very$ strictly.
Change	Indicate how much you think your everyday life has changed
Perception	during the period of confinement, where $1 = My$ life has not
	changed much; $5 = My$ life has changed a lot.
Back to	Indicate when you think everyday life will return to a situation
Regular Life	similar to before confinement, where $1 =$ Summer 2020; $2 =$
	Autumn 2020; 3 = Winter 2020-2021; 4 = Spring 2021; 5 =
	Summer 2021; 6 = Autumn 2021; 7 = Year 2022; 8 = Year 2023;
	9= Other, please justify your answer in this text box.
Frequency of	Indicate how much you think the number of activities and events
Events	you normally do in a week has changed during the period of
	confinement (assuming that during the confinement many
	activities are now conducted on-line), where $1 = I$ participate in
	considerably fewer activities and events in my weekly schedule;
	5 = I participate in a higher number of activities and events in
	my weekly schedule.
Boredom	Indicate how much more or less bored have you been during
	confinement than in your everyday life before confinement,
	where $1 = I$ have been a lot less bored; $5 = I$ have been much
	more bored.
Mood	In general, how have you felt during the period of confinement?
	Where $1 = \text{Very bad}$; $5 = \text{Very good}$.
Concern about	Overall, how concerned are you about the COVID-19 pandemic
COVID-19	Where $1 = Not$ very concerned; $5 = Very$ concerned.

Data processing

We computed the same indexes as in Study 1. Responses from participants who placed both the past and future events in the same box in the Temporal Diagram Task (N = 38), were filtered out. Since in the online version of our data collection all the items of each questionnaire had to be answered before proceeding to the next questionnaire, no participants were filtered out for leaving items blank. However, 91 participants left the study before answering the Temporal Focus Questionnaire and five more participants (total N = 96) left the study before answering the Religiosity Questionnaire.

We submitted the COVID-19 items to a principal component analysis. This analysis found two main components (see Table IV.3): 1) a Personal Impact component, including measures of Mood, Boredom, Change Perception, and Frequency of Events; and 2) a Social Concern component, which includes measures of Strict Compliance, Change Perception and Back to Regular Life. The Change Perception item loaded on both components. We created two indexes by averaging the items of each component. In addition, we created a COVID-19 Overall Impact Index by averaging all COVID-19 items. Since the Mood and Frequency of Events items correlated negatively with the rest of the items, we reversed them before computing the indexes. All participants responded to all the COVID-19 items. However, responses from 36 participants in the Back to Regular Life item were filtered out because they chose the open-response option for this item, but they did not respond by writing a specific date in the future (instead they wrote, for example, "when the vaccine arrives" or "nobody knows").

Principal Component Analysis of the COVID-19 Items Regarding the Psychological Impact of the Covid-19 Pandemic Arrival

	Component		
Component Loadings	1	2	Uniqueness
Strict Compliance		0.70	0.50
Concern COVID-19		0.74	0.42
Back to Regular Life		0.48	0.74
Change Perception	0.52	0.40	0.54
Mood	-0.72		0.47
Boring	0.77		0.42
Frequency of Events	-0.49		0.75

Note. 'Oblimin' rotation method was used. The loadings below 0.25 are not shown.

Analysis plan

According to Shapiro-Wilk tests, many of the samples from each culture did not follow a normal distribution in the Value Temporal Focus Index, Religiosity Index and COVID-19 indexes (see Table IV.S16 in the Supplementary information), and according to the Lilliefors test, the overall sample was also significantly different from the normal distribution in both indexes (in both cases p < .001). So, we also carried out non-parametric analyses in Study 2. We reported analyses describing relations (by means of Kendall's *Tau-B* Correlation Coefficients and binary logistic regressions) between the psychological impact of the pandemic, as measured by the COVID-19 Overall Impact Index and the two COVID-19 factors (personal impact and social concern), with value temporal focus, religiosity, and temporal spatialization both overall and in each culture (see Supplementary information, Figure IV.S5 and IV.S6 for a detailed item-wise analysis).

Results

We correlated by means of Kendall's Tau-B Correlation Coefficients the three indexes measuring the COVID-19 psychological impact (i.e., Overall, Personal Impact, and Social Concern indexes) with the Religiosity Index, Value Temporal Focus Index, and the proportion of future in front. The results are shown in Table IV.4. First, as in the smaller sub-sample of Study 1, the Religiosity and Value Temporal Focus Indexes correlated negatively. Centrally, all three COVID-19 indexes were negatively correlated with the Religiosity Index and positively correlated with the Value Temporal Focus Index: participants reporting greater psychological impact of the pandemic had lower religiosity and were more future-oriented. The effect sizes of all these correlations were small, except for the correlation between religiosity and value temporal focus which was large (note that the Kendall's Tau-B effect size corresponds to larger effect sizes when converted to Pearson's r or Spearman's r, see Gilpin, 1993). There were no significant differences between the size of the correlations between the Personal Impact and Social Concern Indexes with the Religiosity Index, Z = 0.84, p = 0.40, and the Value Temporal Focus Index, Z = -0.35, p = 0.73. Thus, both the personal and social-concern pandemic's dimensions were related to religiosity and value temporal focus to a similar extent.

Table IV.4

	Religiosity Index	Value Temporal Focus Index	Proportion Future in Front
Personal	-0.06*	0.08**	0.08***
mpact Index	<i>N</i> = 797	<i>N</i> = 802	<i>N</i> = 855
Social	-0.08**:	0.09***	0.05
Index	<i>N</i> = 797	<i>N</i> = 802	<i>N</i> = 855
Overall	-0.07**	0.09***	0.07*
Impact Index	N= 797	N= 802	N= 855

Kendall's Tau-B Correlation Coefficients Between the COVID-19 Overall, Personal Impact, and Social Concern Indexes With the Religiosity Index, the Value Temporal Focus Index, and the Proportion of Future in Front

Note. *Statistically significant results are marked with asterisks: *p < .05, **p < .01, ***p < .001.

We also assessed the relation between time spatialization and the rest of the variables by means of binary logistic regressions. Placing the future in front was predicted by both the COVID-19 Overall Impact Index, Wald $\chi 2 = 6.64$, p = .01, OR = 1.42, 95% CI = [1.09, 1.86], and the Personal Impact Index, Wald $\chi 2 = 8.55$, p < .01, OR = 1.3, 95% CI = [1.113, 1.718], but not by the Social Concern Index, Wald $\chi 2 = 2.019$, p = .16, OR = 1.2, 95% CI = [0.94, 1.439]. Lastly, the effects on temporal spatialization of the Religiosity Index, Wald $\chi 2 = 0.003$, p = .96, OR = 0.97, 95% CI = [0.86, 1.15], and the Value Temporal Focus Index, Wald $\chi 2 = 0.88$, p = .35, OR = 157, 95% CI = [0.61, 4.06], did not reach statistical significance, although they were both in the expected direction.

When considering the results within cultures it is important to keep in mind the small sample sizes in several of them. Even so, almost all statistically significant results followed the direction of the global results. First, according to the Kendall's tau-b correlation coefficient, the correlation between the Religiosity and Value Temporal Focus Indexes was negative and statistically significant in all cultures (see Figure IV.S7 in the Supplementary information): Croats (N = 71), $\tau b = -.45$, p < .001, Bosniaks (N = 21), τb = -.36, p < .05, Serbs (N = 70), τb = -.51 p < .001, Americans (N = 70), τb = -.2, p < .05, Turks (N = 43), $\tau b = -.26$, p < .05, Spaniards (N = 366), $\tau b = -.283$, p < .001, and Chinese $(N = 126), \tau b = -.15, p < .05$, with the only exception of the Moroccans $(N = 32), \tau b = -$.21 p = .09. Second, placing the future in front was positively and significantly predicted by the COVID-19 Personal Impact Index in Croats (N = 72), Wald $\chi 2 = 7.3$, p < .01, OR = 4.3, 95% CI = [1.5, 12.17], and Spaniards (N = 378), Wald $\chi 2 = 5.7$, p = .02, OR = 1.6, 95% CI = [1.1, 2.3], and by the COVID-19 Social Concern Index in Bosniaks (N = 20), Wald $\chi 2 = 4$, p = .047, OR = 6.31, 95% CI = [1.03, 38.72]. The only statistically significant result against expectations was that placing the future in front was positively predicted by the Religiosity Index in Serbs (N = 68), Wald $\chi 2 = 5$, p = .026, OR = 2.12, 95% CI = [1.1, 4.1]. No other tests reached significance in the within culture analyses.

General Discussion

In the present work, we studied the relationship between the arrival of the COVID-19 pandemic and its associated social restrictions (mainly total lockdown) and the changes in religiosity, value temporal focus, and temporal spatialization in young people from

cultures that vary from a high religiosity and strong past focus to a low religiosity and strong future focus. To this end, we conducted two studies.

Study 1 confirmed the strong negative relationship between religiosity and value temporal focus and showed that young people tested during the first period of severe social restrictions were less religious (hypothesis 1), more future-focused - more oriented to progress than tradition — (hypothesis 2) and located the future in front in a greater proportion (hypothesis 3) than young people tested before the arrival of the pandemic. Although these results are consistent with an effect of the pandemic, there are (at least) two alternative potential causes for those differences between the samples collected before and during the pandemic: First, the pre-COVID-19 group was tested in the lab using paper and pencil, whereas the COVID-19 group was tested by means of an online survey. One possible cause of the findings in Study 1 might be that less religious and more future-focused individuals were more likely to take online surveys during confinement because of their greater use of technologies than the more religious and pastfocused individuals. We call this possibility the online-preference hypothesis. Second, the pre-pandemic samples were collected four or five years (except the Chinese sample, which was collected only one year) before the pandemic. This opens the possibility that the effects we have found are just the result of the mere passage of time, perhaps due to the on-going secularization process which makes people (especially young adults) become less religious and traditional in many cultures (Inglehart, 2021; Norris & Inglehart, 2011; Pew Research Center, 2018). We call this possibility the secularizationdrift hypothesis. To rule out these two alternative accounts, we carried out Study 2 using the total sample collected during the pandemic. As both accounts propose that the observed changes occur because of causes unrelated to the pandemic, we assessed the relation of the changes with the psychological impact that the pandemic had for the individual. The two accounts predict that no relation should be found.

We found two components regarding the impact of the pandemic, one relative to personal impact (including the perception of a greater change in regular life, worse mood, greater boredom, and fewer activities carried out during social restrictions) and another related to social concern (including greater compliance with social restrictions, greater concern, the belief that a return to normality would take longer time, and the perception of a greater change in regular life). We created an index for each component. We also analyzed an Overall Impact Index with the average of all items. Against predictions from

the online-preference and the secularization-drift hypotheses, all three indexes were negatively associated with religiosity (hypothesis 4) and positively associated with value temporal focus (hypothesis 5). Moreover, both the Overall Impact Index and the Personal Impact Index correlated positively with placing the future in front (hypothesis 6). Additionally, we observed a strong negative relationship between religiosity and value temporal focus. Although correlational designs do not afford, by their very nature, the drawing of causal inferences, the possibility that the pandemic is the cause of the observed changes in religiosity, temporal values, and time spatialization is strengthened when we consider the results of Study 1 and Study 2 together.

Regarding cross-cultural differences, present data indicated that the changes observed during the pandemic occurred to a comparable extent in cultural groups that vary widely in their overall pre-pandemic level of religiosity and value temporal focus (see Figure IV.4 above and Tables IV.S12- IV.S15 in the Supplementary information). When young people from the less religious and more future-focused cultural samples (Chinese, Spaniards, and Turks) were pooled together and compared to matched young people from more religious and past-focused cultural samples (Moroccans, Croats, Bosniaks, and Serbs), we did not observe differences in the direction and size of the changes in any measure. Thus, the pandemic was associated with lower religiosity, greater future focus, and greater tendency to place the future in front in young people across cultures, regardless of the overall religiosity and value temporal focus that each culture showed before the pandemic.

Note that due to the small size of many cultural samples in our data, we can only make cross-cultural comparisons with at least an 80% statistical power when comparing the set of the more religious and past-focused versus the set of less religious and future-focused cultures in Study 1 (when we achieved a minimum of 308 participants in each group; see Figure IV.4 above). In contrast, the analyses comparing single cultures did not have enough statistical power in either of the two studies: In Study 1, to find the effects shown in the Religiosity ($r_B = -.24$) and Value Temporal Focus Indexes ($r_B = .3$) in the overall sample (see Figure IV.1A) with a 80% probability and an alpha of .05, we would need a minimum sample size of N = 34 and N = 55 respectively in each culture group and time-period (i.e., before and during the COVID-19). However, sample size in some cultures did not reach that minimum (see Table IV.1). In Study 2, to find the largest effect size observed in the whole sample (i.e., the correlation between the Value Temporal

Focus Index and the COVID19 Overall Index, *Kendall's Tau-B* = .09, equivalent to *Pearson's r* =-.14, see Gilpin, 1993) within any given culture, with an 80% power and alpha of .05, we would need a minimum of 313 subjects. Thus, the statistical power to detect these correlations within most cultures was lower than 80%. Therefore, only analyses of the overall data and those regarding the comparison of the two sets of cultures (more religious and oriented to the past versus less religious and oriented to the future) in Study 1 enjoyed a satisfactory level of statistical power.

The fact that the changes observed during the pandemic were not moderated by prior religiosity and value temporal focus leaves age as the main candidate factor to explain the findings. While other studies suggest that the arrival of the pandemic boosted the religiosity of older and more religious people (Ganiel, 2021; Jaspal et al., 2020; Mahamid & Bdier, 2021; Meza, 2020; Molteni, 2020; Pew Research Center, 2020b; Thomas & Barbato, 2020), present results suggest that it may have had the opposite effect on young people. In this line, a recent study has also shown that, contrary to what was shown in the general population by other studies, young people in Poland (a country with a high level of religiosity) considered themselves to be less religious because of the pandemic (Dobosz et al., 2022). Also, when analyzing the data pool collected by the Pew Research Center (2020b) in March 2020, we observe that among non-religious Americans, young adults (18-29 years old) were the least likely to associate the arrival of the pandemic with becoming religious; and among religious Americans, young adults were the group that least felt that the pandemic strengthened their faith. They were also the least likely to pray for an end to the spread of coronavirus and to engage with religious services during the coronavirus outbreak. All in all, our results challenge religious coping and comfort views, suggest the need to take into account the role of age when assessing changes in prayer and religiosity during the arrival of the pandemic (e.g., Bentzen, 2021), and encourage further study of the effect of age on religious coping and comfort during social crises (Pargament, 1997).

Why should young adults across cultures respond to the threat of the pandemic by turning toward progress, technology, and other future-related values, and away from traditions, religion, and other past-related values? A likely possibility is that young adults over the world perceived medical, technological, or epidemiological developments (such as diagnostic tests, vaccines, and social restrictions) as effective means of ending the pandemic (Altinordu, 2021; Galang, 2021; Hill et al., 2020; Schnabel & Schieman, 2021).

In fact, trust in these scientific developments has been found to be negatively related to both religiosity and conservatism during the pandemic (Plohl & Musil, 2021). Furthermore, science skepticism has been shown to reduce compliance with COVID-19 shelter-in-place policies, which was a problem in overcoming the pandemic (Brzezinski et al., 2021). Consistently, Study 2 showed that the more young people were concerned with the pandemic, the more their religiosity weakened, the more the importance given to progressive (versus traditionalist) values increased, and the more their tendency to place the future in front strengthened.

The present work not only finds a relation between the pandemic and people's religious beliefs and temporal values, but goes beyond this by showing that there were also changes in temporal spatialization. As predicted by the Temporal Focus Hypothesis (TFH, de la Fuente et al., 2014; Callizo-Romero et al., 2020), Study 1 showed that greater future focus (and associated lesser religiosity) when comparing participants collected before versus during COVID-19 occurred with a concomitant increase of future-in-front responses. When data from the pandemic period were analyzed separately (Study 2), neither temporal focus nor religiosity were able to significantly predict time spatialization, but the psychological impact of the pandemic did: greater impact predicted placing the future in front. Impact was, in turn, a good predictor of value temporal focus and religiosity.

These findings contrast with Li and Cao (2021a)'s findings who observed that a reminder of the COVID-19 threat increased past temporal focus and placing the past in front in Chinese participants. Several explanations for this contrast are possible. We can discard one first possibility linked to Li and Cao's use of a different measure of temporal focus. Li and Cao (2021a) operationalized temporal focus as personal temporal focus (i.e., the attention and thought given to the personal past vs. future) using the Temporal Focus Scale developed by Shipp et al. (2009) instead of the Temporal Focus Questionnaire that we used here to measure value temporal focus. As shown by Callizo-Romero et al. (2022), both measures may dissociate. Conveniently, in the COVID-19 Time Project in which the present work has been carried out, we also collected data about personal temporal focus (using the Temporal Focus Scale) to address a different research goal (see Methods section). These data can address this issue. We have added to the Supplementary information (tables IV.S17 and IV.S18) two correlation matrixes between the three COVID-19 indexes, a Personal Temporal Focus Index (computed analogously to the

Value Temporal Focus Index), and the proportion of future in front responses in both the Chinese (S17) and the overall (S18) samples collected during the pandemic. Contrary to Li and Cao (2021), we found a positive and significant correlation between both the COVID-19 Social Concern and Overall Impact indexes and the Personal Temporal Focus Index in the Chinese sample (in both cases p < .022, N = 130, see S17; no other correlation was statistically significant). We found no significant correlations in the overall sample (see S18). That is, in the Chinese participants (but not in the overall sample), the greater the psychological impact of the pandemic, the greater their focus on their *personal* future. Therefore, present data are inconsistent with the findings by Li and Cao (2021a) also regarding personal temporal focus, thereby ruling out this first possibility. A second possibility is that the Chinese participants in Li and Cao (2021)'s study were older (*median age*: 38.2) than in our study (*mean age*: 19.96). Yet other differences between the two studies remain (e.g., experimental vs. correlational design). More research is needed before we can explain these contradictory patterns.

In conclusion, the present findings advance knowledge about the changes that occurred in young people's religiosity, temporal values, and time spatialization during the COVID-19 pandemic and its consequent social restrictions. Against expectations from religious coping and comfort views, during the first stage of pandemic social restrictions (mainly total lockdowns), young adults from cultures that varied widely in their prepandemic religiosity and temporal values were less religious, more focused on futurerelated than past-related values, and located the future in front to a greater extent than young adults collected before the pandemic. Moreover, during the pandemic, young adults who experienced a greater psychological impact due to the pandemic also showed lesser religiosity, stronger future-focus in their temporal values, and greater tendency to locate the future in front. The COVID-19 crisis appeared in front of us deus ex machina which translates literally as "god from the machine." While other studies that focused on more religious and older populations have shown an increase in the number of participants who sought god in facing the pandemic (e.g., Ganiel, 2021; Meza, 2020), our results suggest that young people paid more attention to the *machina* (i.e., progress and future) than to *deus*.

Acknowledgements and funding

Author Contributions (according to CRediT): Carmen Callizo-Romero: Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Visualization, Project administration, Funding acquisition. Daniel Casasanto, Tilbe Göksun, Alexander Kranjec, Marc Ouellet, and Slavica Tutnjević: Resources, Writing - Review & Editing, Funding acquisition. Sobh Chahboun and Yan Gu: Resources, Writing - Review & Editing. Julio Santiago: Conceptualization, Methodology, Validation, Resources, Data Curation, Writing -Original Draft, Supervision, Project administration, Funding acquisition. This paper is part of the doctoral dissertation of Carmen Callizo-Romero under the supervision of Julio Santiago in the psychology doctoral program at the University of Granada. All the authors declare to have no conflict of interest.

All materials, datasets, and computer code (script) are publicly available at Open Science Framework:

https://osf.io/htxck/?view_only=e09625af99e740be88e1f04a5fa13f4a.

The present work is fully reproducible using those materials. The data from the Temporal Focus Questionnaire and the Temporal Diagram Task from the sample collected before COVID-19 were used as part of the wider analyses in Callizo-Romero et al. (2020, 2022). In the present study we report for the first time the data from the Religiosity Questionnaire collected before the pandemic, and all the data collected during the pandemic.

We are grateful to Maja Pandza and Sladjana Ilić for helping us with the sample collected before the COVID-19 pandemic. This research was supported by grant PSI2015-67531-P from the Spanish Ministry of Economy and Competitivity to Julio Santiago (PI), Daniel Casasanto, Tilbe Göksun, Alexander Kranjec, Marc Ouellet and Slavica Tutnjević, as well as by a predoctoral contract (BES-2016-076717) and a Fulbright grant (PS00326707), both to Carmen Callizo-Romero.

Supplementary information

Tables

Table IV.S1

Participants Matched for Temporal Diagram Task From Samples Collected Before and During the Covid-19 Pandemic in the Following Variables: Culture, Age, Sex, Education^a, and Handedness

Culture ^b	Condition	Ν	M age	Female	Right
Moroccans	Pre	40	23.53	63%	95%
	During	40	23.73	78%	92%
Croats	Pre	57	21.39	75%	89%
	During	57	21.97	86%	95%
Bosniaks	Pre	21	21.38	81%	100%
	During	21	21.33	86%	100%
Serbs	Pre	79	21.91	67%	89%
	During	79	22.2	95%	90%
Americans	Pre	46	21	91%	96%
	During	46	21	91%	96%
Turks	Pre	35	22	69%	97%
	During	35	22.17	77%	89%
Spaniards	Pre	175	20.85	87%	91%
	During	175	20.85	87%	94%
Chinese	Pre	90	19.26	90%	96%
	During	90	19.33	91%	99%
TOTAL	Pre	543	22.14	95%	90%
	During	543	21.1	81%	93%

Note. Pre = sample collected before the pandemic; During = sample collected during the pandemic.

^aAll the matched participants were university students. ^bThe cultures appear ordered (from top to bottom) from the most to the least religious before the pandemic.

Mann-Whitney Independent Samples Test for the Overall Samples Collected During Versus Before the COVID-19 Pandemic in the Whole Set of Religiosity and Values Temporal Focus Subscales

			95% Correla	Rank-Biserial	
	W	р	Rank-Biserial Correlation	Lower	Upper
Religiosity Belief	102875.0	< .001	-0.167	-0.236	-0.096
Religiosity Practice	93000.0	< .001	-0.247	-0.313	-0.178
Religiosity Knowledge	96782.5	<.001	-0.216	-0.284	-0.147
Religiosity Index	94519.5	<.001	-0.235	-0.301	-0.166
VTF Past	87928.50	<.001	-0.288	-0.352	-0.221
VTF Future	145673.0	<.001	0.179	0.109	0.248
VTFI	160941.5	< .001	0.303	0.237	0.367

Note. Relig. = Religiosity; VTF = Value Temporal Focus

Culture ^a	Condition	Relig.	Relig.	Relig.	Relig.	VTF	VTF	VTF
		Belief	Pract.	Knowl.	Index	Future	Past	Index
Moroccans	Pre	4.78	3.92	4.33	4.36	3.30	3.80	-0.06
	During	4.90	3.93	5.00	4.45	3.45	3.55	0.00
Croats	Pre	4.68	3.74	4.20	4.32	3.20	3.60	-0.04
	During	4.50	3.21	4.00	3.97	3.15	3.10	0.01
Bosniaks	Pre	4.84	3.97	4.73	4.41	3.20	3.60	-0.05
	During	3.20	3.29	3.33	3.34	3.40	2.60	0.06
Serbs	Pre	4.04	3.51	4.47	4.10	3.00	3.80	-0.1
	During	3.40	2.71	3.67	3.31	3.40	3.10	0.08
Americans	Pre	3.60	3.06	4.17	3.66	3.03	3.17	-0.02
	During	3.50	2.43	3.33	2.94	3.40	2.45	0.14
Turks	Pre	3.00	2.43	2.67	2.67	3.28	2.72	0.05
	During	2.20	1.57	1.67	1.88	3.60	2.10	0.28
Spaniards	Pre	2.20	1.86	3.00	2.33	3.30	2.70	0.08
	During	1.60	1.29	2.33	1.67	3.40	2.40	0.15
Chinese	Pre	1.60	2.14	2.00	1.82	3.20	2.80	0.05
	During	1.60	1.86	1.00	1.57	3.20	2.70	0.06
All	Pre	2.80	2.57	3.33	2.85	3.20	3.00	0.03
	During	2.20	1.86	2.67	2.26	3.30	2.60	0.11

Medians of, Religiosity Belief, Religiosity Practice, Religiosity Knowledge, Religiosity Index, Value Temporal Focus Future, Value Temporal Focus Past, and Value Temporal Focus Index in each cultural group

Note. Relig. = Religiosity; VTF = Value Temporal Focus; Pre = sample collected before the pandemic; During = sample collected during the pandemic.

^aThe cultures appear ordered (from top to bottom) from the most to the least religious before the pandemic.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Moroccans

				95% CI for Correlation	r Rank-Biserial
	W	р	Rank-Biserial Correlation	Lower	Upper
Relig. Belief	269.000	0.510	0.112	-0.229	0.428
Relig. Practice	196.000	0.285	-0.190	-0.491	0.151
Relig. Knowled	. 305.500	0.122	0.262	-0.076	0.547
Relig. Index	249.000	0.879	0.029	-0.306	0.357
VTF Past	170.500	0.095	-0.295	-0.571	0.040
VTF Future	261.500	0.655	0.081	-0.258	0.402
VTF Index	295.500	0.213	0.221	-0.120	0.515

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Croats

				95% CI for Rank- Biserial Correlation		
	W	р	Rank-Biserial Correlation	Lower	Upper	
Relig. Belief	932.000	0.105	-0.191	-0.402	0.039	
Relig. Practice	798.500	0.010	-0.307	-0.500	-0.085	
Relig. Knowled.	981.500	0.207	-0.148	-0.364	0.083	
Relig. Index	858.000	0.032	-0.255	-0.457	-0.029	
VTF Past	760.500	0.004	-0.340	-0.527	-0.121	
VTF Future	1066.000	0.530	-0.075	-0.298	0.156	
VTF Index	1351.500	0.145	0.173	-0.057	0.386	

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Bosniaks

				95% CI for Correlation	Rank-Biserial
	W	р	Rank-Biserial Correlation	Lower	Upper
Relig. Belief	113.500	0.007	-0.485	-0.708	-0.175
Relig. Practice	130.000	0.023	-0.410	-0.658	-0.083
Relig. Knowled	. 76.000	<.001	-0.655	-0.814	-0.406
Relig. Index	102.000	0.002	-0.537	-0.742	-0.242
VTF Past	114.000	0.008	-0.483	-0.707	-0.172
VTF Future	291.500	0.074	0.322	-0.019	0.596
VTF Index	339.000	0.003	0.537	0.242	0.742

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

				95% CI for Rank- Biserial Correlation	
	W	р	Rank-Biserial Correlation	Lower	Upper
Relig. Belief	1372.500	0.003	-0.308	-0.479	-0.116
Relig. Practice	1208.500	<.001	-0.391	-0.548	-0.208
Relig. Knowled.	1190.500	<.001	-0.400	-0.555	-0.218
Relig. Index	1122.500	<.001	-0.434	-0.583	-0.257
VTF Past	1019.500	<.001	-0.486	-0.625	-0.317
VTF Future	2867.500	<.001	0.445	0.269	0.592
VTF Index	3139.500	< .001	0.582	0.433	0.700

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference Before Versus During COVID-19 in Serbs

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Americans

				95% CI for Rank- Biserial Correlation	
	W	р	Rank-Biserial Correlation	Lower	Upper
Relig. Belief	729.000	0.010	-0.311	-0.507	-0.084
Relig. Practice	795.500	0.041	-0.248	-0.455	-0.016
Relig. Knowled.	739.500	0.012	-0.301	-0.499	-0.073
Relig. Index	720.000	0.008	-0.319	-0.514	-0.094
VTF Past	509.000	<.001	-0.519	-0.671	-0.325
VTF Future	1532.000	<.001	0.448	0.240	0.617
VTF Index	1705.000	<.001	0.612	0.442	0.739

Note. Relig. = Religiosity; VTF = Value Temporal Focus.
				95% CI for Correlation	Rank-Biserial
	W	р	Rank-Biserial Correlation	Lower	Upper
Relig. Belief	518.500	0.271	-0.153	-0.403	0.117
Relig. Practice	382.000	0.007	-0.376	-0.584	-0.123
Relig. Knowled	. 454.500	0.062	-0.258	-0.490	0.009
Relig. Index	444.500	0.049	-0.274	-0.503	-0.009
VTF Past	371.500	0.005	-0.393	-0.597	-0.142
VTF Future	866.000	0.003	0.414	0.166	0.612
VTF Index	898.000	< .001	0.466	0.229	0.651

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Turks

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

For the Mann-Whitney test, effect size is given by the rank biserial correlation.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Spaniards

				95% CI for Rank-Biseria Correlation		
	W	р	Rank-Biserial Correlation	Lower	Upper	
Relig. Belief	11188.000	< .001	-0.269	-0.378	-0.154	
Relig. Practice	11221.500	< .001	-0.267	-0.376	-0.151	
Relig. Knowled	. 11620.500	< .001	-0.241	-0.351	-0.124	
Relig. Index	10641.000	< .001	-0.305	-0.411	-0.192	
VTF Past	11453.000	< .001	-0.252	-0.362	-0.136	
VTF Future	16860.000	0.101	0.101	-0.020	0.219	
VTF Index	18800.500	< .001	0.228	0.110	0.339	

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

For the Mann-Whitney test, effect size is given by the rank biserial correlation.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference of Samples Collected During Versus Before COVID-19 in Chinese

				95% CI for Rank-Biserial Correlation		
	W	р	Rank-Biserial Correlation	Lower	Upper	
Relig. Belief	4013.000	0.488	0.060	-0.111	0.228	
Relig. Practice	2638.000	<.001	-0.303	-0.450	-0.140	
Relig. Knowled.	2053.000	<.001	-0.458	-0.583	-0.311	
Relig. Index	2672.000	<.001	-0.294	-0.442	-0.130	
VTF Past	3280.500	0.128	-0.133	-0.297	0.038	
VTF Future	4026.500	0.466	0.064	-0.108	0.232	
VTF Index	4286.500	0.131	0.133	-0.039	0.296	

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

For the Mann-Whitney test, effect size is given by the rank biserial correlation.

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference Before Versus During COVID-19 in Participants From Cultures That Before the Pandemic Had a Low Religiosity and Were Future-focused^a

				95% Cl Biserial (for Rank- Correlation
	W	р	Rank Biseri Correlation	al Lower	Upper
Relig. Index	30750.500	<.001	-0.303	-0.385	-0.216
VTF Index	54447.000	< .001	0.234	0.145	0.320

Note. Relig. = Religiosity; VTF = Value Temporal Focus.

For the Mann-Whitney test, effect size is given by the Rank Biserial correlation. ^aParticipants from cultures with low religiosity and future-focused are Turks, Spaniards, and Chinese participants.

Table IV.S13

Mann-Whitney Independent Samples Test of Religiosity and Value Temporal Focus Indexes for the Difference Before Versus During COVID-19 in Participants From Cultures That Before the Pandemic Were Highly Religious and Past-focused^b

				95% C Biserial	l for Rank- Correlation
	W	р	Rank Biserial Correlatio n	Lower	Upper
Relig. Index	8055.500	<.001	-0.321	-0.431	-0.200
VTF Index	16578.000	< .001	0.398	0.284	0.501

Note. Relig. = Religiosity; VTF = Value Temporal Focus. For the Mann-Whitney test, effect size is given by the Rank Biserial correlation. ^bParticipants from cultures with high religiosity and past-focused are Moroccans, Bosniaks, Croats, and Serbs.

Comparison Between the Effect Sizes of Cultures That Before the Pandemic had a Low
Religiosity and Were Future-oriented Versus Those Which Had a High Religiosity and
Were Past-oriented in Religiosity and Value Temporal Focus Indexes

			95% CI		
	Fisher's Z	<i>p</i>	Lower	Upper	
Relig. Index	0.22	.82	-0.16	0.19	
TFIndex	-1.89	.06	-0.33	0.01	

Note. Relig. = Religiosity; VTF = Value Temporal Focus. The effect sizes compared (future-oriented vs. past-oriented cultures) are the result of the difference between Before Versus During COVID-19 shown in tables IV.S12 and IV.S13.

Table IV.S15

Odds Ratio of Proportion of Future in Front for the Difference from Cultures That Before the Pandemic Had a Low Religiosity and Were Future-focused Versus Those Which Had a High Religiosity and Were Past-focused

		95% CI	
	OR	Lower	Upper
More religious and past-focused cultures	1.58	1.05	2.39
Less religious and future-focused cultures	1.35	0.95	1.92

Median and Shapiro-Wilk p Values of Religiosity Index, Value Temporal Focus Index, COVID19 Personal-affectation Index, COVID19 Social Concern Index, and Overall COVID19 Index in Each Culture in the Whole Collected During the COVID19 Pandemic

	Culture	Religiosity Index	Value Temporal Focus Index	COVID19 Personal affectation Index	COVID19 Social Concer Index	COVID19 Overall Index
Median	Moroccans	4.43	-0.01	3.25	3.25	3.29
	Croats	3.98	0.01	2.75	3.00	2.86
	Bosniaks	2.90	0.03	3.00	3.50	3.15
	Serbs	3.27	0.07	3.00	3.00	3.00
	Americans	3.10	0.13	3.75	3.75	3.86
	Turks	2.16	0.28	3.25	3.50	3.43
	Spaniards	1.70	0.14	3.50	3.75	3.57
	Chinese	1.59	0.07	3.25	3.00	3.21
Shapiro Wilk n	Moroccans	0.004	0.04	0.17	<.001	0.03
vv nik p	Croats	<.001	0.49	0.14	0.16	0.04
	Bosniaks	0.367	0.06	0.20	0.30	0.87
	Serbs	0.008	0.70	0.28	0.38	0.34
	Americans	0.559	0.06	0.01	0.21	0.26
	Turks	<.001	0.09	0.33	0.01	0.27
	Spaniards	<.001	0.02	<.001	<.001	0.033
	Chinese	<.001	<.001	0.01	<.001	0.03

Note. P-value results lower than .005 indicate that the sample did not follow the normal distribution.

Kendall's Tau-B Correlation Coefficients Between the COVID-19 Overall, Personal, and Social Concern Indexes With the Proportion of Future in Front, and the Personal Temporal Focus Index in the Chinese Young Sample Collected During the COVID-19 Pandemic

	Future in Front	Personal Temporal Focus
	III FI OIIt	Index
Personal Temporal	Tb = 0.08, p = .301, N = 118	
Focus Index		
COVID-19 Personal	Tb = .05, p = .458, N = 144	Tb = .11, p = .108, N = 130
Index		
COVID-19 Social	Tb = .02, p = .82, N = 144	Tb = .15, p = 0.021, N = 130
Concern Index		
COVID-19 Overall	Tb = .00, p = 0.98, N = 144	Tb = .11, p = .077, N = 130
Index		

Table IV.S18

Kendall's Tau-B Correlation Coefficients Between the COVID-19 Overall, Personal, and Social Concern Indexes With the Proportion of Future in Front, and the Personal Temporal Focus Index in the Overall Young Sample Collected During the COVID-19 Pandemic

	Future	Personal Temporal Focus
	in Front	Index
Personal Temporal	Tb = 0.002, p = .949, N =	
Focus Index	770	
COVID-19 Personal	Tb = 0.0825, p < 0.001, N =	Tb = .038, p = .13, N = 808
Index	855	
COVID-19 Social	Tb = 0.0509, p = .081, N =	Tb =018, p = 0.466, N =
Concern Index	855	808
COVID-19 Overall	Tb = 0.073, p = 0.02, N =	$Tb =0434, \ p = .078$, $N =$
Index	855	808

Figures

Figure IV.S1

Distribution of Religious Denominations or Religious Positions in Each Culture From the Matched Samples of Participants Collected Before (A) and During the Pandemic (B)



Note. All percentages greater than or equal to 4% are shown. The cultures appear ordered (from top to bottom) from the most progressive to the most traditionalist according to data collected before the pandemic.

Effect Size of the Difference between the Religiosity Index with the value 3.3 (Which is the Average of the Religiosity Index of the Overall Pre-pandemic Sample) in Each Culture



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results are marked with asterisks: * p < .05, *** p < .001.

This plot was computed with data from the entire sample collected before the pandemic, and not only with the subsample matched with the sample collected during the pandemic. Sample sizes in each culture are the followings: Spaniards (N = 192), Chinese (N = 96), Turks (N = 96), Americans (N = 158), Moroccans (N = 138), Bosniaks (N = 99), Croats (N = 100), and Serbs (N = 190).

Effect Size of the Difference between the Asymmetry Index from the Value Temporal Focus Questionnaire with Zero in Each Culture According to the Whole Sample Collected Before the Pandemic



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results are marked with asterisks: * p < .05, *** p < .001.

This plot was already reported in Callizo-Romero (2022). It was computed with data from the entire sample collected before the pandemic, and not only with the subsample matched with the sample collected during the pandemic. Sample sizes in each culture are the followings: Spaniards (N = 192), Chinese (N = 96), Turks (N = 96), Americans (N = 159), Moroccans (N = 139), Bosniaks (N = 99), Croats (N = 100), and Serbs (N = 188).

Percentage of Each Religious Denomination or Religious Position in Each Culture from the Total Sample Collected During COVID-19.



DURING COVID-19 (ALL PARTICIPANTS)

Note. All percentages greater than or equal to 4% are shown.

Heatmap Showing Kendall's Tau-B Correlation Coefficients Between the Temporal Focus Index and Religiosity Index With Each Other (Area A); Between These and The COVID-19 Items (Area B); and Between The COVID-19 Items With Each Other (Area C)

			А							
	Religiosity computed		-0.306***	В						
oncern	Stric compliance	_	0.093***	-0.158***						С
or 2 Social C	Concern COVID19	_	0.058	-0.069	0.246***					
	Back regular life		0.019	0.01	0.082	0.191***				
Fac	Change perception	_	0.091***	-0.086**	0.063	0.188***	0.155***			
rsonal	Mood		-0.043	0.011	0.003	-0.149***	-0.072	-0.252***		
r 1 Per	Boring	_	0.029	-0.035	-0.056	0.07	0.034	0.215***	-0.294***	
Facto	Events number		-0.067	0.041	0.002	-0.027	-0.001	-0.06	0.134***	-0.192***
			I	Della inclu	01.1	Concern	Deale			

TFI Religiosity Stric Concern Back Change Mood Boring computed complianceCOVID19regular lifeperception

Note. The sample sizes of the correlations were the following: between the temporal focus items and the religiosity items (area A; N = 798); between the temporal focus items and the COVID-19 items (area B; N = 802) except for the Back regular life item (area B; N = 766); between the religiosity items and the COVID-19 items (area B; N = 766); between the religiosity items and the COVID-19 items (area B; N = 797) except for the Back regular life item (area B; N = 762); between the COVID-19 items to each other (area C; N = 893) except for the item back regular like (area C; N = 855).

*The multiple correlations from the correlation matrix were corrected by the Holm-Bonferroni method.

Statistically significant results are marked asterisks: p < .05, p < .01, p < .01, p < .001.

Heatmap showing Kendall's tau-b correlation coefficients between the Temporal Focus Future, Temporal Focus Past, Religiosity Belief, Religiosity Practice, and Religiosity Knowledge to each other (area A); between these and the COVID-19 items (area B); and between the COVID-19 items to each other (area C)

					Α								
TF future	-0.17***												
Religiosity computed –	0.332***	-0.11***	-0.307***										
Religiosity belief	0.345***	-0.111***	-0.316***										
Religiosity practice _	0.365***	-0.145***	-0.35***	0.636***									
Religiosity knowledge	0.247***	-0.054	-0.217***	0.491***	0.46***		в						
Stric compliance –	-0.066	0.082	0.093***	-0.169***	-0.152***	-0.126***	-0.156***						с
Change perception –	-0.076	0.062	0.091***	-0.107***	-0.138***	-0.023	-0.086**	0.061					
Concern COVID19	-0.032	0.078	0.058	-0.069	-0.073	-0.059	-0.069	0.244***	0.189***				
Events number	0.061	-0.005	-0.066	0.06*	0.054	0.007	0.039	0.001	-0.059	-0.027			
Boring _	-0.006	0.072**	0.029	-0.024	-0.013	-0.037	-0.034	-0.054	0.215***	0.07	-0.192***		
Mood _	0.037	-0.042	-0.043	0.018	0.025	0.006	0.011	0.003	-0.252***	-0.149***	0.134***-	0.294***	
Back regular life	-0.032	-0.024	0.017	-0.009	-0.02	0.043	0.011	0.081**	0.155***	0.191***	-0.002	0.034	-0.071*
	TF	 TF	 TF	Relig.	Relig.	Relig.	Relig.	Stric	Change	Conc.	Events	Boring	Mood
	past	future	Index	belief	practice	Knowl.	Comp.	compl.	percept.	COVID	number		

Note. The sample sizes of the correlations were the following: between the temporal focus items to each other (area A; N = 802); between the religiosity items to each other (area A; N = 797); between the temporal focus items and the religiosity items (area A; N = 798); between the temporal focus items and the COVID-19 items (area B; N = 802) except for the Back regular life item (area B; N = 766); between the religiosity items and the COVID-19 items (area B; N = 797) except for the Back regular life item (area B; N = 797) except for the Back regular life item (area B; N = 797) except for the Back regular life item (area B; N = 762); between the COVID-19 items to each other (area C; N = 893) except for the item back regular like (area C; N = 855).

*The multiple correlations from the correlation matrix were corrected by the Holm-Bonferroni method. Statistically significant results are marked with asterisks: *p < .05, **p < .01, ***p < .001.

Scatter-Plot Showing the Correlations Between Religiosity Index and Temporal Focus Index During The COVID-19 Pandemic in Each Cultural Group.



Note. The regression line and its standard error are shown for each culture.



CHAPTER V: STUDY III

TEMPORAL FOCI AND TIME ASYMMETRIES ACROSS CULTURES⁸

⁸ The content of this chapter has been published as:

Callizo-Romero, C., Tutnjević, S., Pandza, M., Ouellet, M., Kranjec, A., Ilić, S., Gu, Y., Göksun, T., Chahboun, S., Casasanto, D., & Santiago, J. (2022). *Does time extend asymmetrically into the past and the future? A multitask crosscultural study*. Language and Cognition, 14(2), 275-302. <u>https://doi.org/10.1017/langcog.2022.5</u>

Highlights (in relation to research goals):

- People from different cultures varied in both their personal temporal focus (in relation to research goal #1.3).

- Value temporal focus is dissociated from personal temporal focus (in relation to research goal #1.5).

- We found asymmetry in all tasks except time distance (in relation to research goal #3.1).

- We found (only) an effect of the value temporal focus on the time discounting (in relation to research goal #3.2).

- Past and future maintained a positive relationship in the human mind (in relation to research goal #3.3).

- We did not find a correlation between the temporal asymmetries, which indicated that they are not part of the same temporal construct (in relation to research goal #3.4).

Abstract

Does temporal thought extend asymmetrically into the past and the future? Do asymmetries depend on cultural differences in temporal focus? Some studies suggest that people in Western (arguably future-focused) cultures perceive the future as being closer, more valued, and deeper than the past (a future asymmetry), while the opposite is shown in East Asian (arguably past-focused) cultures. The proposed explanations of these findings predict a negative relationship between past and future: the more we delve into the future, the less we delve into the past. Here, we report findings that pose a significant challenge to this view. We presented several tasks previously used to measure temporal asymmetry (self-continuity, time discounting, temporal distance, and temporal depth) and two measures of temporal focus to American, Spanish, Serbian, Bosniak, Croatian, Moroccan, Turkish, and Chinese participants (total N=1075). There was an overall future asymmetry in all tasks except for temporal distance, but the asymmetry only varied with cultural temporal focus in time discounting. Past and future held a positive (instead of negative) relation in the mind: the more we delve into the future, the more we delve into the past. Finally, the findings suggest that temporal thought has a complex underlying structure.

Keywords: cross-cultural studies, self-continuity, temporal asymmetry, temporal depth, temporal distance, time discounting, temporal focus.

Introduction

It is common to think that we move in time away from the past and towards the future (Horwich, 1987). The interest in the future is so psychologically central for many of us that Seligman et al. (2016) coined the term *Homo prospectus*. However, at the same time, humans have a "historical consciousness" (Rüsen, 2004), which reaches back into the past, allowing a person to understand their own identity or to plan and set goals for the future (Karniol & Ross, 1996). Overall, this suggests that the way people perceive the past and the future is interrelated. For example, our future self-image depends on how we remember our past self (Markus, 1977); our estimation of the probability that an event will occur in the future depends on how we perceive a similar event in the past (Si et al., 2016); and the value we give to expected future events depends on the value we gave to similar events in the past (Wirtz et al., 2003).

Yet, does the future feel closer than the past? Does the future feel more valuable and more similar to the present than the past or does the asymmetry favor the past instead? Or maybe people adjust to objective reality and conceptualize past and future symmetrically? In a nutshell, the central question that we set out to answer is: do people conceptualize the future and the past symmetrically or asymmetrically?

Some studies have supported a future asymmetry in temporal thought (see Table V.S1 in Supplementary Materials for a detailed breakdown of studies, samples, tasks, and results). For example, Caruso et al. (2013) showed that future events are perceived as being closer to the present than objectively equidistant events in the past. Such asymmetry, which they termed the Temporal Doppler Effect, appears as early as the age of four (Burns et al., 2019). Caruso et al. (2013), following proposals by Clark (1973) and Lakoff and Johnson (1980), proposed that this asymmetry arises because the concrete experience of moving through space is used to conceptualize the more abstract domain of time. Thus, the experience of "moving" through time inherits the experience of physical motion, such as the impression that objects that we approach are closer to us than objects we leave behind.

Other findings are also consistent with this view. Bluedorn (2002) observed a future-asymmetry using a temporal depth task: when he asked people to estimate in specific time units what a short-term, mid-term, and long-term future or past is for them, they looked farther into the future than into the past. Other studies have shown that future

events are valued more than past events, both economically and emotionally (Buni, 2012; Burns et al., 2019; Caruso, 2010; Caruso et al., 2013; Caruso et al., 2008; Helzer & Gilovich, 2012; Kristal et al., 2019; Newby-Clark & Ross, 2003; Ross & Newby-Clark, 1998; Quoidbach et al., 2013; Van Boven & Ashworth, 2007), and Molouki et al. (2019) found that as temporal distance to the present increased participants discounted past rewards more strongly than future ones. Finally, some studies have also shown that we tend to feel more continuity (similarity) with our future selves than with our past selves (Quoidbach et al., 2013; Rutt & Löckenhoff, 2016).

A different set of studies have suggested that the temporal asymmetry varies crossculturally, depending on the culture's predominant temporal focus: the balance of attention and thinking that people devote to the future versus the past. Guo et al. (2012) showed that asking people to spend a few minutes thinking of things they did the past year versus the next year was enough to change the monetary valuation of a past versus a future event according to the priming. Attentional patterns can become habits and there is evidence that individuals differ in their predominant temporal focus. Future-focused people tend to be younger (de la Fuente et al., 2014), more conscientious (Li & Cao, 2017), liberal (Lammers & Baldwin, 2018; Li & Cao, 2020a), optimistic (Li & Cao, 2020b), organizational, proactive, efficient, open to change (Kruglanski et al., 2015; Shipp & Aeon, 2019; Shipp et al., 2009), and anxious (Eysenck et al., 2006; Rinaldi et al., 2017) than past-focused people. Culture can also modulate temporal focus (Callizo-Romero et al., 2020; de la Fuente et al., 2014; Li et al., 2018). The future asymmetries described in the previous paragraphs have all been found in Western samples, which are arguably more focused on the future than the past. East Asian cultures have been claimed to be past-focused (Guo et al., 2012; Ji et al., 2009; Kluckhohn & Strodtbeck, 1961). Consistently, a past asymmetry was found in Chinese participants: compared to Westerners, they gave a higher economic and emotional evaluation to past than future events (Guo et al., 2012; see also Guo & Spina, 2019).

The temporal motion hypothesis proposed by Caruso et al. (2013) can account for individual and cross-cultural differences in the degree of future temporal asymmetry but not for a full reversal (a past asymmetry), as this would seem to imply movement backwards in time. Guo et al. (2012) proposed a different explanation: The variations in temporal asymmetry in Westerners versus East Asians are caused by the balance of attention and thinking devoted to past versus future, i.e., temporal focus (see also de la

Fuente et al., 2014, and Callizo-Romero et al., 2020, for a similar proposal regarding time spatialization). Here, it is important for present purposes to emphasize that both accounts share a prediction: The magnitude of responses toward the future and toward the past must be negatively related. That is, the more we delve into the future, the less we delve into the past, and vice versa. This follows necessarily from the proposed underlying mechanisms. Motion toward the future implies motion away from the past. In the physical Doppler Effect, a single formula explains the rise in pitch as the object approaches the observer and its decrease as the object moves away (Doppler, 1842). The mechanisms of temporal focus can generate a temporal asymmetry between past and future in only one way: by devoting a greater amount of attention and thought (resources) to one than the other. As resources are considered to be limited, devoting more attention to the future should come with devoting less to the past.

All in all, what might be termed the dominant picture on this issue is that there is a basic future asymmetry that is strengthened in future-focused Western cultures but is reduced in past-focused East Asian cultures (specifically, Chinese) where it could become a past asymmetry. Two theoretical proposals have been put forward to explain this pattern: a temporal motion hypothesis and a Temporal Focus Hypothesis. Both accounts agree that the observed asymmetries should be accompanied by a negative relation between past and future. As the evidence supporting the dominant picture comes from very different temporal tasks, it is also an implicit methodological assumption in this field that temporal cognition manifests itself consistently in different measures of temporal thinking and valuation.

The dominant picture, however, has several limitations. First, some studies with Western participants did not support asymmetrical thinking with regards to temporal distance (Ji et al., 2019, study 1b), self-continuity (Guo & Spina, 2019; Molouki et al., 2019, studies 2a and 2b; and Rutt & Löckenhoff, 2016), and time discounting (Bickel et al., 2008; Molouki et al., 2019, study 2a; Pope et al., 2019; Stieg & Dixon, 2007; and Yi et al., 2006). Second, the predominance of the past focus in East Asian cultures has also been challenged (Gan, 2017; Gao, 2016; Ji et al., 2019; Wang et al., 2011). Third, some intercultural studies (Ji et al., 2019) found numeric past asymmetries in temporal distance for both Chinese and Western samples, although the relevant contrast between past and future was not carried out. Others such as Ji et al. (2009) only tested the past condition. Finally, there are three important methodological limitations in the available research: 1)

Cross-cultural differences in temporal focus have been assumed on a priori grounds, but temporal focus has not been explicitly measured; 2) to the best of our knowledge, the only (arguably) past-focused culture that has been explored is Chinese culture; and 3) no study has assessed several temporal tasks simultaneously in the same sample of participants, meaning we cannot be certain of the degree to which they render consistent results.

The present work aimed to overcome the methodological limitations in available research. We employed several different tasks used in the previous literature (adapting them when necessary) to assess temporal asymmetry: self-continuity, time discounting, temporal distance, and temporal depth, both toward the past and the future. We collected data from eight Western, Middle East, and East Asian cultural groups that were expected to differ in their temporal focus: Americans, Spaniards, Serbs, Croats, Bosniaks, Moroccans, Turks, and Chinese. Instead of assuming different degrees of temporal focus across our cultural samples, we measured this variable, and did so in two different ways: First, we measured the balance between past (tradition) and future (progress) temporal values by means of the Temporal Focus Questionnaire developed by de la Fuente et al. (2014). Second, we measured the balance between attention and thinking devoted to the personal past and future by means of the Temporal Focus Scale developed by Shipp et al. (2009).

With this methodological approach, the current work set out to answer four questions: 1) Is there asymmetry or symmetry toward past and future in each task? In other words, is the magnitude of responses towards the future stronger or weaker than the magnitude of responses toward the past? 2) Do past and future hold a negative or a positive relation in the mind? A negative relation means that individuals who produce responses of greater magnitude toward the future show a corresponding decrease in the magnitude of their responses toward the past (and vice versa). A positive relation between the past and the future occurs when the magnitude of responses toward the future and the past go hand in hand (note that this question is orthogonal to the presence or absence of asymmetry). 3) Do the putative asymmetries depend on temporal focus in such a way that people in more future-focused cultures show stronger future-asymmetries than those in past-focused cultures (who may even show past asymmetry)? Finally, 4) are the putative asymmetries in the different tasks correlated with each other? This would support the claim that the tasks measure a common psychological substrate.

Methods

All materials, data, and statistical analyses of the study reported in this paper can be accessed at https://osf.io/bwt5r/.

Participants

Overall, 1075 students took part in the study (702 female, 364 male, 1 other, 8 non-responses). All participants were university students, mostly in their early twenties (*M*age=21.37 years, range=15–63, with only 3.3% older than 30). University students may not accurately represent their country's overall population or testing site, but they provide samples of comparable age and education.

The data were collected in three waves. The Spanish sample (N=192) was collected at the Faculty of Psychology, University of Granada, Spain, both in the first (N=96) and second (N=96) waves; the American sample (N=159) was collected at McAnulty College and Graduate School of Liberal Arts, Duquesne University, Pittsburgh, Pennsylvania, USA, both in the first (N=64) and second (N=96) waves. The Moroccan group (N=142) was tested in two cohorts in the second wave, separated by several months and in different locations. Many Moroccan participants from the first cohort gave signs of not being motivated and/or not understanding well the written items (e.g., left some subtasks without response, marked the same value in all items of a task, gave values for shortmedium-long past or future which were not temporally ordered; or chose only one item in the entire time discounting task), which motivated the collection of a second cohort of participants. The first cohort of the Moroccan (N=96) sample was tested at the Faculty of Arts, Abdelmalek Essaadi University, Tetouan, Morocco, and the second cohort (N=46) at the Faculty of Law, University of Tanger, Morocco. The Turkish group (N=96) was tested at Koç University, Istanbul, Turkey, in the second wave. In Bosnia-Herzegovina (total N=387), the Serbian sample (N=188) was collected at the University of Banja Luka both in the first (N=96) and second (N=94) waves, the Croatian sample was collected at the University of Mostar (N=100) in the second wave, and the Bosniak sample was collected at the University of Tuzla (N=99) in the second wave. Finally, the Chinese sample (N=96) was collected at the Jiangsu Normal University, Xuzhou, China in the third wave.

The testing site was adopted as a proxy for each cultural group, such that in the analyses, all participants tested in each testing site were included in their respective

cultural groups. We understand that this is not totally accurate, so we asked the participants about cultural identity in our questionnaires. However, it seems that the question was not understood correctly sometimes, and the answers were often unclear, so it was decided to include all the participants collected in a city within that cultural group. Nonetheless, this problem can not affect any of the within-participant contrasts. Moreover, as our between-group contrasts are based on explicitly measured temporal focus, and not on assumed temporal focus, we do not think that this problem threatens any of our conclusions. All participants signed the informed consent to participate. The study was approved by the Ethics Committees of the University of Granada (code 300/CEIH/2017), Duquesne University, and Koç University.

Materials

The tasks were translated from English into the language from each sample (Spanish, Chinese, Arabic, Turkish, and Serbian/Croatian/Bosnian) by bilingual researchers. We used the back-translation technique to confirm the equivalence of the translation between different language versions.

Self-continuity

To measure self-continuity, we used the Self-continuity Scale by Ersner-Hershfield et al. (2009), for which Rutt and Lóckenhoff (2016) devised a past version. Participants were asked to think about themselves 10 years from now (future version) or 10 years ago (past version), and then they had to choose among seven pairs of circles labelled "current self"/"future self" (Figure V.1A) or "current self"/"past self" (Figure V.1B) that ranged from complete separation (1=least similar) to almost complete overlap (7=most similar).

Figure V.1

Images Used in the Future (A) and (B) Past Version of the Self-Continuity Scale



Time discounting

We used the Time Discounting Scale developed by Kirby and Marakóvic (1996), which is a classic measure widely used to study temporal discounting (Frederick et al., 2002). It consists of 21 items offering a choice between an immediate but smaller, and a delayed but larger amount. Thus, the participant had to choose between, for example, "\$45 tonight or \$70 in 35 days". The original task only measured time discounting toward the future. In the present study, we created a past version using the same amounts and delays, e.g., participants chose between \$45 last night or \$70 35 days ago. We computed the frequency of choosing the distant option in each version. The temporal intervals ranged from 10 to 75 days. In the American version, the amounts offered ranged from \$16 to \$85. Amounts in the scale were translated into the different currencies of the countries involved in this study applying conversion rates based on Purchasing Power Parity, such that they would be roughly equivalent for the participants.

Intuitively, a reward already given in the past may seem very different than a reward to be given in the future. However, both temporal distances involve trade-offs that may affect the value a person assigns to the reward: A larger reward in the distant past may be less attractive than a smaller reward received recently because the former may have already been spent at the present moment. A larger reward in the distant future (vs. a

shorter reward immediately) forces the participant to wait before getting it. Previous studies show abundant evidence that people discount past rewards. And tasks comparing past and future time discounting have been used to address the question of temporal asymmetry before (see Table V.S1).

Temporal distance

We used the Temporal Distance Task from Caruso et al. (2013; study 1a). This task has both a future and a past version. Participants were asked either to think ahead to exactly one month from today (future version) or to think back to exactly one month ago (past version) and were asked how long this time interval feels. Participants had to respond on a Likert scale from 1 (*a really short time from now*) to 5 (*a really long time from now*). The only difference between the task by Caruso et al. (2013) and ours is that they used a 10-point response scale, and we used a 5-point response scale.

Temporal depth

We measured temporal depth with a slight adaptation of the task developed by Bluedorn (2002). This task presents three questions referring to different temporal depths (short-term, mid-term, and long-term) concerning both the past and the future. In our adaptation, questions about the future and the past were phrased using the same terms. The short-term future version used the following sentence: "When I think of the short-term future, I usually think of events that will occur ______ from now"; and for the past version: "When I think of the short-term past, I think of events that occurred ______ ago". The expression 'short-term' was replaced by 'midterm' and 'long-term' in the midterm and the long-term version respectively. In Bluedorn's (2002) task, participants chose from a fixed set of 15 response options showing increasingly longer temporal distance (being, for example, 1=one day, 2=one week, [...] 14=25 years, and 15=more than 25 years). Instead, we gave participants complete freedom to choose any temporal amount, but participants were instructed to respond with a specific moment, not a temporal range. When they still gave a range (e.g., "2 or 3 months"), we took the midpoint.

Temporal focus

We used two measures of temporal focus.

Temporal Focus Questionnaire

The first measure of temporal focus was de la Fuente et al.'s (2014) Temporal Focus Questionnaire, with a slight adaptation (one item was removed). This questionnaire measures the value given to past (tradition) versus future (progress). It contained 20 items: 10 referred to past-related values (e.g., "The traditional way of living is better than the modern way") and 10 referred to future-related values (e.g., "It is important to innovate and to adapt to changes"). Each item was followed by a Likert scale from 1 (*total disagreement*) to 5 (*total agreement*). The items were presented in random order in the first wave, but in the second wave they were presented in strict alternating order, as in de la Fuente et al. (2014). In the third wave we used the same order as in the second wave, except for two items which exchanged places due to experimenter error. In addition, the American version of the questionnaire in the first wave and the Turkish version in the second wave used 9-point scales, so the responses to these versions were converted to the range 1–5. The McDonald's Omega coefficients (ω) for the past and future items in the Temporal Focus Questionnaire were, respectively: $\omega = .84$ and $\omega = .69$ in Spaniards; $\omega = .86$ and $\omega = .78$ in Serbs; $\omega = .90$ and $\omega = .79$ in Croats; $\omega = .87$ and $\omega = .71$ in Bosniaks; $\omega = .84$ and $\alpha = .67$ in Moroccans; $\omega = .87$ and $\omega = .81$ in Turks; and $\omega = .67$ and $\omega = .73$ in Chinese.

Temporal Focus Scale

The second measure of temporal focus was Shipp et al.'s (2009) Temporal Focus Scale. This instrument measures the amount of attention and thinking devoted to the personal past, present, and future. It contains 12 items, three devoted to the past (e.g., "I think about things from my past"), three to the present (e.g., "My mind is on the here and now"), and three to the future (e.g., "I think about times to come"). Each item was followed by a Likert scale from 1 (*never*) to 5 (*constantly*). The items from the three subscales were presented to the participants, but the present subscale was not analyzed because it is irrelevant to the question of temporal asymmetry. The McDonald's Omega coefficients (ω) for the past and future items in the Temporal Focus Scale were, respectively: ω =.83 and ω =.81 in Spaniards; ω =.84 and ω =.72 in Americans; ω =.91 and ω =.71 in Serbs; ω =.90 and ω =.76 in Croats; ω =.90 and ω =.83 and ω =.73 in Chinese.

Procedure

The present study is part of a wider project aimed to assess time conceptualization across a wide range of cultures using a variety of tasks, some of which form the basis of the current paper. The sample of the present work has recently been used in another published article (Callizo-Romero et al., 2020) in which we investigated how temporal focus affects

temporal spatialization. In the present work, we focus on the question of whether people conceptualize the past and the future symmetrically or asymmetrically.

Data were collected in three different waves. In the first wave, data was collected from Spanish, American, and Serbian participants using only the Temporal Depth Task and the Temporal Focus Questionnaire, as well as other tasks not reported in this article. In the second wave, the Self-Continuity Scale, the Time Discounting Scale, and the Temporal Distance Task, as well as a new measure of temporal focus, the Temporal Focus Scale, were added along with other tasks. We collected new samples of previous cultural groups (Spaniards, Americans, and Serbs), as well as Bosniaks, Croats, Moroccans, and Turks. In the third wave, a sample of Chinese participants was collected who performed the same tasks as the samples collected in Wave 2. No participant performed the tasks more than once. In our analyses we used the data from the three waves pooled together. The minimum sample size of each cultural group in each wave was established at 96 before the beginning of data collection. This number resulted from doubling the minimum number (48) necessary for a full run of the counterbalancing of all the tasks not described here, some of which had several versions).

The tasks were completed in corresponding universities' facilities for each sample, using pen and paper. Participants received a leaflet with the battery of tasks. The leaflet started with the instructions and the consent form. Next, the participants filled in a demographic questionnaire. After that, temporal tasks appeared in this order: Self Continuity Scale, Time Discounting Scale, Temporal Distance Task, and Temporal Depth Task (except for Wave 1 of data collection, where the first three tasks were not used). Participants performed both versions (past and future) of the tasks in a counterbalanced order, such that half the participants started with the past versions of all the tasks followed by the future versions in the same order, while the other half started with the future versions followed by the past versions. The penultimate task of this series was always the Temporal Focus Scale, and the final task was the Temporal Focus Questionnaire (with the exception of Wave 1, when the former was not used). At the bottom of each page, the instructions emphasized that participants should not turn the page until the exercise on that page had been completed nor to look ahead or back to other pages.

Data processing and analysis

We pre-processed the data to eliminate invalid responses. First, we filtered out data that fulfilled certain criteria indicating poor attention or faulty understanding of the tasks' instructions. The first criterium was applied to all multi-item tasks (temporal discounting and the two tasks measuring temporal focus). We removed participants who did not show any variability in their responses over items or left more than four items blank. For this reason, in the Time Discounting Scale, 79 participants were filtered out (most from the first Moroccan cohort, what led to the collection of the second Moroccan cohort), leaving a total sample in that task of N=740. In the Temporal Focus Scale one participants were filtered out (total N=814). In the Temporal Focus Questionnaire, six participants were filtered out (total N=1069). A second criterium was applied to the Temporal Depth Task, where we filtered out 195 participants because they either did not respect the temporal progression of short, medium and, long terms (i.e., gave a shorter time for a longer-term horizon) or, more often, gave a too vague estimation in at least one item (e.g., they wrote "weeks" or "years"). The final sample size in this task was N=880. In the Self-Continuity Scale (N=815) and the Temporal Distance Task (N=816), no participant was removed.

Statistical analyses were tailored to answer our four questions: the asymmetry question, the question about the sign of the relation between past and future (positive or negative), the temporal focus question, and the question of whether the tasks measure a single underlying temporal dimension. The analyses were conducted for each task both on the overall sample and within each cultural group.

To answer the asymmetry question, we took both between-groups and withinparticipant approaches in order to rule out the possibility of strategic effects when the same participant was asked about both the past and the future (see Caruso et al., 2008). All participants responded to both the past and future versions of each task. Due to counterbalance, half of the participants responded first to the past versions of all tasks while the other half responded first to the future versions of all tasks. This allowed us to perform both a within-participant analysis, using all responses, as well as a betweengroups analysis using only the responses to the version of the tasks that was responded to in first place. Thus, for the between-groups analyses, we compared the responses to the past versions of the task in one half of the participants to the responses to the future versions of the task in the other half.

For the within-participant analyses, we computed an asymmetry index for each participant in each task. In order to secure a common interpretation for all the tasks' indexes, we inverted the response values in the Temporal Distance Task's scale (that is, we computed 1 as "a really long time from now" and 5 as "a really short time from now"). In this way, greater values in this task indicate a smaller distance to the event. In the Self-Continuity Scale, greater values also indicate a greater self-continuity to a distant self (see Figure V.1). In the Time Discounting Task, we counted the number of distant choices, which indicates less discounting (i.e., greater value of distant rewards). Finally, in the Temporal Depth Task, we converted all responses to days, and computed four indexes: short, medium, and long-term indexes as well as a general index using the standard deviation of the scores in the three temporal depths (short, medium, and long). Greater values indicate a longer temporal horizon, which is consistent with a closer perceived distance (and greater value) of more distant events.

Computing asymmetry indexes eases cross-measures comparisons by putting all of them on a common scale. For the interested reader, the median and interquartile ranges of each past and future condition in each culture are reported in the Supplementary Materials (see Tables V.S2- V.S4). The creation of the asymmetry indexes in all measures followed the strategy used by de la Fuente et al. (2014): Index = [mean of future version responses – mean of past version responses] / [mean of future version responses + mean of past version responses]. The indexes expressed the asymmetry between the responses in the past and future versions on a scale from -1 to +1. An index significantly greater than zero means a future asymmetry. That is, a positive index indicates, as compared to the past, greater continuity with the future self, perception of smaller distance to the future event, greater patience for future economic rewards, greater than zero means a past asymmetry.

In order to assess whether the relation between past and future processing is positive or negative, we computed correlations between the responses to the past and future versions of each task over participants, both within cultural groups and over the whole sample.

To answer the temporal focus question, we averaged responses to the items in the past and the future subscales of both the Temporal Focus Questionnaire and the Temporal Focus Scale. Then, we computed asymmetry indexes for each measure, following the same approach described above. For simplicity, we will call the index that comes from the Temporal Focus Questionnaire "value temporal focus": it represents the balance between the importance given to past (tradition) and future (progress) temporal values; and we will call the index that comes from the Temporal Focus Scale "personal temporal focus": it represents the balance between the attention and thinking devoted to the personal past vs. future.

We then took both a group-level and an individual-level approach. For the grouplevel approach, we ranked cultures from future-focused to past-focused in each of the temporal focus indexes, and assessed whether the size of the asymmetries observed in the other temporal tasks agreed with this ranking. Moreover, we also pooled together all cultures that showed qualitatively different kinds of temporal focus in each index and contrasted them in the temporal tasks. At the individual-level approach, we computed correlations between each temporal focus index and the asymmetry indexes of the temporal tasks.

Finally, in order to answer the question about the existence of an underlying temporal dimension, we correlated the asymmetry indexes of each task with each other and we also performed an exploratory factor analysis (using the minimum residual extraction method).

Since all samples have more than 50 participants, deviations from normality were checked with the Lilliefors test (based on the Kolmogorov-Smirnov test) showing that the asymmetry indexes for the overall sample in all the tasks did not follow a normal distribution (in all cases p<.01). Analyses for each task within each culture, both regarding the asymmetry indexes as well as in the past and future versions taken independently showed that normality was violated in most cases (the supplementary data and analysis scripts allow the replication of these tests). For this reason, we turned to non-parametric analyses. We report the uncorrected p values, but we carried out corrections for False Discovery Rate (FDR) over the set of relevant comparisons following Benjamini and Hochberg (1995), and also report what contrasts did survive the correction. We based our conclusions only on those tests that remained significant after FDR correction.

Results

Is there asymmetry in temporal cognition?

Between-groups analysis of temporal asymmetry

When comparing within each culture the group that responded to the past versions of the tasks in the first half of the task battery with the group that responded to the future versions, Mann-Whitney tests revealed a significant future asymmetry in self-continuity in Spaniards, U = 748.5, p < .01, $r_{rb} = .21$, 95% CI [.07, .34]; Americans, U = 812, p = .01, $r_{\rm rb} = .2, 95\%$ CI [.05, .35]; Serbs, $U = 817, p = .04, r_{\rm rb} = .15, 95\%$ CI [.01, .28]; Croats, $U = 963, p = .04, r_{\rm rb} = .2, 95\%$ CI [.02, .39]; and Turks, $U = 605, p < .001, r_{\rm rb} = .4, 95\%$ CI [.24, .58]; but not in Bosniaks, U = 1082, p = .32, $r_{rb} = .1$, 95% CI [-.12.030]; Moroccans, $U = 2351, p = .48, r_{rb} = .06, 95\%$ CI [-.12, .23]; and Chinese, $U = 1139, p = .92, r_{rb} = .01, r_{rb} = .01$ 95% CI [-.2, .21]. After FDR correction, the comparisons in Americans, Serbs, and Croats became unsignificant. In the rest of the tasks the only significant asymmetries were a future asymmetry in time discounting in both the Spaniards, U = 818, p = .01, $r_{rb} = .18$, 95% CI [.04, .31], and the Chinese, U = 595, p < .001, $r_{rb} = .42$, 95% CI [.25, .58], and in temporal depth in Chinese both in the general measure, U = 746, p < .01, $r_{\rm rb} = .28$, 95% CI [.09, .48], and in the long term, U = 757, p < .01, $r_{\rm rb} = .27$, 95% CI [.07, .47]. All these contrasts remained significant after FDR correction. Summing up, we found significant future asymmetry in self continuity in Spaniards and Turks; in time discounting in Spaniards and Chinese; and in temporal depth in Chinese, both in the general measure and in the long term. No other culture in any task showed significant asymmetry.

Pooling together all participants in each task, we found an overall future asymmetry in self-continuity, U = 66157, p < .001, $r_{rb} = .16$, 95% CI [.1, .22] and in time discounting, U = 75006, p < .01, $r_{rb} = .08$, 95% CI [.016, .14], both of which remained significant after FDR correction. No temporal asymmetry was found in temporal distance and temporal depth, neither in the general measure nor in the short, medium, or long terms (in all cases p > .3).

Within-participant analysis of temporal asymmetry

We used the responses of all participants to both the past and future versions of the tasks to compute asymmetry indexes as detailed above. The overall results and most of the culture-wise results revealed a similar pattern of findings to the between-group analysis as well as an additional asymmetry in the Temporal Depth Task (Table V.1 shows sample sizes in each index and culture, Figure V.2 shows the results, and Figure V.3 breaks down the Temporal Depth Task into the three asymmetry indexes). Wilcoxon rank tests showed that the self-continuity index was significantly greater than zero in Spaniards, W = 2962, $p < .001, r_{\rm rb} = .4, 95\%$ CI [0.3, 0.51]; Americans, $W = 2434, p < .001, r_{\rm rb} = .31, 95\%$ CI [.18, .44]; Serbs, W = 1654, p < .001, $r_{rb} = .25$, 95% CI [.13, .38]; Bosniaks, W = 1802, $p < .001, r_{\rm rb} = .42, 95\%$ CI [.26, .58]; Croats, $W = 2220, p < .001, r_{\rm rb} = .57, 95\%$ CI [.45, .69]; and Turks, W = 2150, p < .001, $r_{rb} = .42$, 95% CI [.24, .59]; but not in Chinese, W =1667, p = .13, $r_{rb} = .15$, 95% CI [-.04, .35]; and Moroccans, W = 2232, p = .72, $r_{rb} = .03$, 95% CI [-.14, .19]. FDR correction did not change these findings. Time discounting showed a future asymmetry in Spaniards , W = 2196, p = .04, $r_{\rm rb} = .15$, 95% CI [.019, .29]; which became unsignificant after FDR correction, and Chinese, W = 2491, p<.001, $r_{\rm rb} = .51, 95\%$ CI [.37, .66]; which remained after FDR correction. There was also asymmetry in the general temporal depth index in Chinese, W = 2502, p < .001, $r_{rb} = .43$, 95% CI [.26, .60], which also remained after FDR correction. Regarding each of the temporal depths, we only found asymmetry in the Turks in the mid-term, W = 1629, p =.02, $r_{\rm rb} = .23$, 95% CI [.03, .42]; and in the Chinese in all depths: short-term, W = 1285, $p = .03, r_{tb} = .22, 95\%$ CI [.04, .42], mid-term, $W = 1305, p = .04, r_{tb} = .21, 95\%$ CI [.02, .40], and long-term, W = 1828, p < .001, $r_{rb} = .41$, 95% CI [.25, .58]. However, after FDR correction, only the asymmetry in the long-term temporal depth in Chinese remained. Summing up, all cultures except Moroccans and Chinese showed future asymmetry in self-continuity, and only the Chinese showed future asymmetry in time discounting and both general and long-term temporal depth. No other culture in any task showed asymmetry.

We analyzed the overall asymmetry in each task by pooling all participants together (see Figure V.4). We found a significant future asymmetry in the self-continuity index, W = 134341, p < .001, $r_{rb} = .30$, 95% CI [.25, .35]; the time discounting index, W = 93772, p < .001, $r_{rb} = .11$, 95% CI [.05, .17]; and the temporal depth index, W = 144476, p = .001, $r_{rb} = .10$, 95% CI [.04, .16]; but we did not find an overall asymmetry in the temporal distance index, W = 53689, p = .38, $r_{rb} = .-03$, 95% CI [-.09, .04]. In temporal depth, the asymmetry was only present in the long-term, W = 87621, p = .01, $r_{rb} = .08$, 95% CI [.02, .14], but not in the mid or short terms (in both cases, p > .36). All the significant tests remained significant after FDR correction.
Table V.1

Country Culture	Spani- ards	Chi-	Turk	s Ameri-	Moro-	Bos- niaks	Croats	Serbs
Self-Continuity	95	96	96	96	141	98	100	93
Index								
T. Discounting Index	95	93	96	96	83	94	96	87
T. Distance Index	96	96	96	96	142	99	100	94
T. Depth Short Index	x 144	94	88	121	99	82	89	162
T. Depth Mid Index	144	94	88	121	100	82	89	162
T. Depth Long Index	144	94	88	121	100	82	89	162
T. Depth SD Index	144	94	88	121	100	82	89	162
T. Focus Index (TFQ)	192	96	96	159	139	99	100	188
T. Focus Index (TFS)	96	96	96	96	137	99	100	94

Sample Size of Asymmetry Indexes in Each Task and Each Culture

Figure V.2

Bar Graphs Representing the Effect Size of Asymmetry Indexes Computed for Each Task in Each Culture Ordered From the Most Future-Focused to the Most Past-Focused Culture According to the Temporal Focus Questionnaire Index: (A) Self-Continuity Scale; (B) Time Discounting Scale; (C) Temporal Distance Task; (D) Temporal Depth Task



Note. Effect sizes are calculated by Rank-Biserial Correlation. Error bars indicate 95% Confidence Interval of the effect size. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: *** p < .001.

Figure V.3

Bar Graphs Representing the Effect Size of Temporal Depth Indexes Computed for Each Culture Ordered From the Most Future-Focused to the Most Past-Focused Culture According to the Temporal Focus Questionnaire Index: (A) Short-Term (B) Midterm; (C) Long-Term



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: *** p < .001.

Figure V.4

Bar Graph Representing the Effect Size of the Difference of Temporal Asymmetry Indexes with Zero Computed for Each Task in the Overall Sample



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: * p < .05, ** p < .01, *** p < .001.

Do past and future hold a positive or a negative relationship in the mind?

Kendall's Tau B correlation coefficient (FDR corrected) showed that the past and future versions were significantly and positively correlated in all tasks and cultures (in all cases p<.01), with the only exceptions of Serbs in the Self-continuity Scale and Americans in Self-continuity Scale and Time Distance Task (see Table V.2 and Figure V.5).

Table V.2

Kendall's Tau Correlations Between the Past and the Future Versions in Each Task and Culture

	Self- Contin uity	Time Discount.	Temporal Distance	Temporal Depth	T. Depth Short- term	T. Depth Mid- term	T. Depth Long- term
Spaniards	τb = .31*** N=95	τb=.6*** N=95	τb=.22** N=96	τb=.61** * N=144	τb=.51** * N=163	τb=.58*** N=165	τb=.67** * N=156
Chinese	τb=.26* ** N=96	τb=.48** * N=93	τb=.25** N=96	τb=.34** * N=94	τb=.41** * N=94	τb=.45*** N=94	τb=.43** * N=94
Turks	τb=.24* * N=96	τb=.40** * N=96	τb=.24** N=96	τb=.39** * N=88	τb=.52** * N=91	τb=.55*** N=91	τb=.43** * N=91
Americans	τb=.08 N=96	τb=.48 *** N=96	τb=.15 N=96	τb=.55** * N=121	τb=.57** * N=129	τb=.65*** N=125	τb=.61** * N=123
Moroccans	τb=.22* ** N=141	τb=.50** * N=83	τb=.37** * N=140	τb=.53** * N=100	τb=.49** * N=90	<i>Tb</i> =.57*** <i>N</i> =100	τb=.57** * N=100
Bosniaks	τb=.28* ** N=98	τb=.62** * N=94	τb=.31** * N=99	τb=.66** * N=82	τb=.64** * N=93	τb=.672** * N=88	τb=.78** * N=86
Croats	τb=.37* ** N=100	$\tau b=.5^{***}$ N=96	τb=.26** N=100	τb=.53** * N=89	τb=.64** * N=93	τb=.74*** N=92	τb=.68** * N=93
Serbs	τb=.14 N=93	τb=.52** * N=87	τb=.30** * N=93	τb=.62** * N=162	τb=.58** * N=167	τb=.64*** N=173	τb=.70** * N=170
Overall	τb=.24* ** N=815	τb=.52** * N=740	τb=.29** * N=816	τb=.56** * N=880	τb=.57** * N=927	τb=.62*** N=928	τb=.62** * N=913

Note. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: ** p < .01, *** p < .001.

Figure V.5

Scatter-Plots Showing the Correlations Between Responses in the Past and Future Versions of Each Task: Self-continuity Scale (A); Time Discounting Scale (B); Temporal Distance Task (C); Temporal Depth Task (D); Temporal Depth Task Short-Term (E); Temporal Depth Task Mid-Term (F); and Temporal Depth Task Long-Term (G)



Note. The regression line and the standard error are shown for each culture.

Does temporal focus affect the asymmetry of the temporal tasks?

Temporal focus regarding past (tradition) vs. future (progress) values

Using the temporal focus index from the Temporal Focus Questionnaire (value temporal focus index), we compared the index in each culture with zero to assess whether the cultures have an asymmetric temporal focus regarding the importance they give to tradition versus progress. According to Wilcoxon rank tests, the value temporal focus index was significantly different from zero in almost all cultural groups (see Figure V.6): we found a future focus in Spaniards, W=14456, p<.001, $r_{rb}=.64$, 95% CI [.56, .72];

Chinese, W=3137, p<.001, $r_{rb}=.53$, 95% CI [.39, .68]; and Turks, W=3481, p<.001, $r_{rb}=.51$, 95% CI [.36, .66]. And a past focus in Moroccans, W=3514, p=.03, $r_{rb}=-.19$, 95% CI [-.35, -.02]; Bosniaks, W=1505, p=.02, $r_{rb}=-.23$, 95% CI [-.42, -.04]; Croats, W=1585, p=.01, $r_{rb}=-.26$, 95% CI [-.44, -.08]; and Serbs, W=3375, p<.001, $r_{rb}=-.49$, 95% CI [-.60, -.37]. Only the Americans did not show a value temporal focus asymmetry, W=6388, p=.29, $r_{rb}=.08$, 95% CI [-.07, .24].

Figure V.6

Bar Graph Representing the Effect Size of the Difference between the Asymmetry Index of the Temporal Focus Questionnaire with Zero in Each Culture



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results are marked with asterisks: * p < .05, *** p < .001.

Figures V.2 and V.3 show the asymmetry indexes in each task and each cultural group. In them, cultures appear ordered according to their value temporal focus index, as shown in Figure V.6: from the more future-focused (on the left) to the more past-focused (on the right). As it is immediately obvious, the degree of temporal asymmetry over cultures did not follow the pattern shown in this temporal focus index in any task. The only finding consistent with expectations is that in time discounting and temporal depth the only culture with a significant future asymmetry (Chinese) is among the three that have a future temporal focus. The size of Kendall's Tau Correlations at the group level (in all cases, N=8) supported these impressions, although none reached significance (Self-continuity: $\tau b = 0$, p=1; Time Discounting: $\tau b = .52$, p=.08; Time Distance: $\tau b = 0$, p=1;

Temporal Depth SD: $\tau b = .04$, p=.9; Temporal Depth Short: $\tau b = .15$, p=.61; Temporal Depth Mid: $\tau b = .44$, p=.13; Temporal Depth Long: $\tau b = .15$, p=.62). To provide a strongest test (with higher statistical power), we also pooled together all participants from cultures with a significant future temporal focus (Spaniards, Chinese, and Turks) and compared their asymmetry indexes in the different tasks with participants from cultures with a past temporal focus (Moroccans, Bosniaks, Croats, and Serbs). The contrast in value temporal focus between the future-focused cultures (N=384) and the past-focused cultures (N=526) was strong and significant, U=479007, p<.001, r_{tb}=.53, 95% CI [.47, .58]. However, future-focused cultures and past-focused cultures only differed significantly in time discounting (future group N=284; past group N=360; U=44524, p < .01, $r_{rb} = .13$, 95% CI [.04, .22]) and in mid-term temporal depth (future group N=326; past group N=433, $U=76549.5, p=.04, r_{\rm rb}=.085, 95\%$ CI [.00, .17]), but only the results in time discounting remained statistically significant after the FDR correction. The difference went in the expected direction: people from future-oriented cultures showed a stronger future asymmetry than past-oriented cultures, which showed symmetry. No other temporal task revealed an effect of this index of temporal focus.

Finally, we tested whether value temporal focus correlated with temporal asymmetries in each task at the individual level, both within each culture as well as over the whole sample of participants. We computed Kendall's Tau B correlation coefficients (with FDR correction) between the value temporal focus index and the asymmetry indexes using only those participants with valid data in the relevant task. The results indicated that temporal focus correlated with time distance in the overall sample, τb =-.06, p=.02, N=815, and with time discounting in Moroccans, τb =.19, p=.02, N=82, but these correlations did not survive FDR correction; and with time discounting in both the overall sample, τ_b =.08, p<.001, N=738, and in Serbs, τ_b =.22, p=.004, N=86, both of which remained after FDR correction.

Temporal focus regarding the attention and thinking devoted to the personal past vs. future

Using the temporal focus index from the Temporal Focus Scale (personal temporal focus index), we again compared the index in each culture with zero to assess whether the cultures have an asymmetrical temporal focus regarding the amount of attention and thinking they devote to the personal past and future (Figure V.7). According to Wilcoxon rank tests, the personal temporal focus index was significantly higher than zero (i.e.,

future-focused) in Croats, W=2823, p<.001, $r_{rb}=.58$, 95% CI [.40, .72]; Serbs, W=2883.500, p<.001, $r_{rb}=.58$, 95% CI [.32, .72]; Bosniaks , W=3067, p<.001, $r_{rb}=.57$, 95% CI [.38, .71]; Americans, W=2635, p<.001, $r_{rb}=.55$, 95% CI [.35, . 70]; and Moroccans, W=5793, p<.001, $r_{rb}=.52$, 95% CI [.36, . 65]. But the personal temporal focus was not significantly different from zero (i.e., the temporal focus was neutral) in Turks, Spaniards, or Chinese (in all cases p>.2). The results remained after FDR correction. It is interesting to note that this measure of temporal focus rendered an ordering of the cultures that basically reversed the ordering obtained from the Temporal Focus Questionnaire based on temporal values: cultures where people think and attend more strongly to their personal future vs. their past also tend to hold stronger past temporal values. However, the correlation of the group rankings between the two temporal focus indexes, although sizeable, was not significant (N=8), $\tau b=-.5$, p=.1.

Figure V.7

Bar Graph Representing the Effect Size of the Difference between the Asymmetry Index of the Temporal Focus Scale with Zero in Each Culture



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results are marked with asterisks: *** p < .001.

Again, the correlation between group rankings in personal temporal focus and each task only pointed to a connection with time discounting, that in this case reached significance (τb =-.79, p=.01), but did not survive FDR correction. All other rank correlations were not significant (in all cases N=8) Self-continuity: τb =-.04, p=.9; Time Distance: τb =.26, p=.4; Temporal Depth SD: τb =-.45, p=.13; Temporal Depth Short:

 τb =-.11, p=.71; Temporal Depth Mid: τb =-.19, p=.53; Temporal Depth Long: τb =-.57, p=.06. To maximize power, we pooled together all participants from cultures with a significant future temporal focus in this measure (Croats, Serbs, Bosniaks, Moroccans, and Americans) and compared their asymmetry indexes in the different tasks with participants from cultures with a neutral temporal focus (Turks, Spaniards, and Chinese). The contrast in personal temporal focus between these two groups of cultures was strong and significant (future-focused: N=526; neutral focus: N=288), U=55835, p<.001, $r_{\rm rb}$ =.26, 95% CI [.18, .34]. The two groups only differed in two temporal tasks, time discounting (future-focused: N=456; neutral focus: N=284), U=56465, p<.01, $r_{tb}=.13$, 95% CI [-.21, -.04]; and temporal depth in the mid (not the long) term (future-focused: N=554; neutral focus: N=326), U=83244, p<.05, $r_{rb}=.08$. However, after FDR correction only time discounting remained significant. The direction of the effect was contrary to expectations: people from cultures with future personal temporal focus showed symmetry whereas people from cultures with neutral temporal focus showed future asymmetry. To allow for a visual appreciation of this pattern, Supplementary Figure V.S1 shows the data in Figure V.2 reordered according to their personal temporal focus: from higher (on the left) to lower (on the right) future focus. That personal and value temporal focus dissociate is also supported by a direct comparison between the cultures with neutral vs. future personal temporal focus in their value temporal focus, which showed a strong difference, *U* =69180, *p* <.001, *r*_{rb} =-.47, 95% CI [-.53, -.42].

We also pursued individual-level analyses with the personal temporal focus index. Firstly, we computed Kendall's Tau B correlation coefficients to assess its relation to the asymmetry indexes of each task both within each culture and in the overall sample, using only those participants with valid data in the relevant task. The results indicated that personal temporal focus correlated with the self-continuity index (N=810), τb =-.06, p=.02, and with the temporal depth index in the mid-term (N=689), τb =.06, p=.03, in the overall sample, but no correlation remained after FDR correction. In the culture-wise analyses, personal temporal focus only correlated with the self-continuity index in Americans (N=96), τb =.16, p=.03, and with the long-term temporal depth index in Croats (N=89), τb =.16, p=.04, but no correlation remained after FDR correction. Moreover, the correlation between value and personal temporal focus was negative but not statistically significant (N=812) τb =-.02, p=.3.

Are the asymmetry indexes correlated with each other? Is there a single factor underlying them?

We finally analyzed the relation between the asymmetry indexes of the different temporal tasks. First, we used Kendall's Tau B correlations with FDR correction (see Table V.3). Pooling together all participants, only the correlations internal to the Temporal Depth Task between the short, mid, and long-term indexes were significant. This also occurred within each culture (in all cases, ps<.01), with the only exception of the correlation between the short-term and mid-term temporal depths in Croats. In addition, the analysis within cultures also revealed, in the Chinese group, significant correlations between time discounting with both the general index of temporal depth (N=91), τb =.20, p=.007, and the long-term index (N=91), τb =.21, p=.006, as well as between the mid-term temporal depth index and time distance (N=94), τb =.-21, p=.007. All of these correlations remained after FDR correction. Other significant correlations that became unsignificant after FDR correction were: a correlation between time discounting and the mid-term temporal depth index (N=88), tb=.20, p=.01, and a correlation between self-continuity and the short-term temporal depth index (N=88), tb=.18, p=.03, in the Turks; a correlation between time distance and the short-term temporal depth index in Americans (N=96), tb=.17, p=.047; and correlations between time distance and both time discounting (N=87), tb=-.16, p=.04 and the general temporal depth index (N=74), tb=.18, p=.03 in Serbs.

Table V.3

	Self Cont. Index	T. Discount . Index	T. Distanc e Index	T. Depth Short Index	T. depth Midd Index	T. Depth Long Index	T. Depth SD Index	Person al T. Focus Index (TFS)
T. Discoun t. Index	τb=- .04 N=73 7							
T. Distance Index	τ <i>b</i> =.0 3 <i>N</i> =81 5	<i>τb</i> =.03 <i>N</i> =740						
T. Depth Short Index	τ <i>b</i> =.0 3 <i>N</i> =68 8	τb=01 N=640	τb=02 N=690					
T. Depth Midd Index	$\tau b = .0$ 0 $N = 68$ 9	<i>τb</i> =.04 <i>N</i> =641	<i>τb</i> =03 <i>N</i> =691	τb=.49** * N=879				
T. Depth Long Index	$\tau b=-$.01 N=68 9	<i>τb</i> =.06 <i>N</i> =641	τb=06 N=691	τb=.30** * N=879	τb=.48** * N=880			
1. Depth SD Index	$\frac{\tau b}{0} = -$ $\frac{.01}{N} = 68$ 9 $\frac{-b}{0} = 0$	<i>τb</i> =.06 <i>N</i> =641	τb=06 N=691				-h	
rerso. T. Focus Index (TFS)	$\begin{array}{l} \tau D=.0\\ 6\\ N=81\\ 0 \end{array}$	τb=02 N=739	<i>τb</i> =02 <i>N</i> =814	$\tau b=.05$ N=688	$\tau b = .06$ N=689	$\begin{array}{l} \tau D = .0 \\ 0 \\ N = 68 \\ 9 \\ \end{array}$	τ <i>b</i> =- .01 <i>N</i> =68 9	
Value T. Focus Index (TFQ)	$ au b=.0 \\ 4 \\ N=81 \\ 1$	τb=.08** * N=738	τb=06 N=815	τb=.01 N=874	<i>τb</i> =.01 <i>N</i> =875	$\tau b=.0$ 1 N=87 5	τb=- .00 N=87 5	<i>τb</i> =02 <i>N</i> =812

Kendall's Tau Correlations Between Asymmetry Indexes and Temporal Focus Indexes

Note. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: *** p < .001.

Second, we carried out an exploratory factor analysis to check if there was a single temporal construct underlying the temporal asymmetries. The minimum residual extraction method was used in combination with an oblimin rotation. The measures introduced in the analysis were the self-continuity index, the time discounting index, the time distance index, and the three asymmetry indexes from the short-, mid-, and longterm temporal depth. The results revealed a factor shared by the three indexes of the temporal depth, but the rest of the indexes were unrelated, having more than 99% uniqueness each one (see Table V.4). This indicates that there is not a common underlying dimension to the asymmetry indexes of the time tasks. This result was expected given the lack of correlation found between asymmetry indexes (see Table V.3).

Factor Loadings	1	Factor	Uniqueness
Self-Continuity Index			0.99
Time Discounting Index			0.99
Time Distance Index			0.99
Temp Depth Short Index		0.67	0.55
Temp Depth Mid Index		0.95	0.09
Temp Depth Long Index		0.68	0.54

Table V.4

Note. The minimum residual extraction method was used in combination with an 'oblimin' rotation. The loadings below 0.3 are not shown.

General discussion

In the present work, we investigated the temporal asymmetry between the past and the future in eight Western, Middle Eastern, and Far Eastern cultures varying in temporal focus, by means of a battery of temporal tasks, in order to answer four questions: 1) Is there asymmetry or symmetry toward the past and the future in each task? In three out of four tasks, we found an overall future asymmetry, which varied strongly in size, while in one task there was symmetry. There was a strong asymmetry towards the future in self-continuity (the future self seems more similar to the present self than the past self), and much smaller asymmetries in time discounting (future rewards are discounted less than past rewards) and temporal depth (future horizons are deeper than past horizons, but only when we ask about long-term horizons). We did not find an asymmetry in time distance.

2) Do past and future hold a negative or a positive relation in the mind? Our results indicated that past and future maintain a positive relation in the mind: the past and future versions of the tasks were strongly positively correlated with each other, both overall and within cultures with very few exceptions. 3) Do the putative asymmetries depend on temporal focus in such a way that people in more future-focused cultures show stronger future-asymmetries than those in past-focused cultures (who may even show past asymmetry)? There was not a gradual effect of temporal focus over the cultures in the degree of asymmetry shown in any of the tasks, neither when temporal focus was operationalized as the value given to past (tradition) vs. future (progress) nor when it was operationalized as the amount of attention and thinking devoted to the personal past vs. future. Unexpectedly, the two measures of temporal focus dissociated: Cultures that were past-focused in terms of temporal values (Moroccans, Bosniaks, Croats, and Serbs) showed strong future focus in terms of personal past and future, and cultures that were strongly future-focused in terms of temporal values (Spaniards, Chinese, and Turks) showed a neutral personal temporal focus. Only when cultures with qualitatively different kinds of temporal focus in each index were pooled together in two groups, we could observe an effect of temporal focus on only one task: time discounting. As expected from the dissociation between temporal focus indexes, this effect was in opposite directions: future asymmetry in time discounting occurred in cultures with future value temporal focus and neutral personal temporal focus, whereas symmetry was found in cultures with past value temporal focus and future personal temporal focus. When we looked at the different cultures, these findings seemed to be driven mainly by the Chinese. Individuallevel correlations over the whole sample only rendered a correlation between value temporal focus and time discounting. 4) Are the putative asymmetries in the different tasks correlated with each other? The asymmetry indexes of the tasks were not related to each other, nor did they share a single underlying temporal construct. In the following, we discuss the present findings in the context of previous literature, and we discuss the implications and limitations of the present work.

Temporal asymmetries

Temporal asymmetry toward the future varied with tasks and cultures. First, the selfcontinuity task showed a future asymmetry both overall and in some cultures. The asymmetry found in Americans in self-continuity is inconsistent with the symmetric pattern found in Americans by Rutt and Lóckenhoff (2016; although they did show asymmetry related to time distance in a different and implicit measure of self-continuity). Our results are also inconsistent with the past-asymmetry shown by Ji et al. (2019) in both Chinese and Euro-Canadians (participants felt more similarity with their past selves than with their future selves). On the contrary, our findings in the Chinese participants are consistent with Guo and Spina's (2019) findings of symmetry in the Chinese.

We also found a smaller overall future-asymmetry in time discounting (people discounted less a future than a past reward), which fits with results by Molouki et al. (2019, studies 1 and b). However, when we looked within each culture, we did not find asymmetry in most of them (only in the Chinese), which agrees with the symmetrical patterns found in previous studies on past and future time discounting (Bickel et al., 2008; Molouki et al., 2019, study 2a; Pope et al, 2019; Stieg & Dixon, 2007; Yi et al., 2006) as well as with the temporal value symmetry observed by Burns et al. (2019) in adults in a different task. It is possible that the asymmetry in time discounting is a small effect that requires larger samples to be found. In addition, Kvam et al. (2021) have recently shown that some factors can affect asymmetry in time discounting. They found an overall pattern of future asymmetry which tends to disappear as the size of the reward is reduced and time increases, giving rise first to a symmetrical pattern and then to a past asymmetry. Unfortunately, procedural differences make it difficult to compare Kvam et al.'s (2021) results with previously reported and present results.

In temporal depth we also found an overall future asymmetry: people's horizons into the future were deeper than into the past. This agrees with the future asymmetry found by Bluedorn (2002). However, in the analyses within each temporal depth, we only found a small future asymmetry in the long term, but not in the mid and short terms. Furthermore, we did not find asymmetry in most cultures. The only exception was China, where we found a future asymmetry in long-term depth.

In contrast, our data about temporal distance showed symmetry: the participants perceived a month into the past as equally close to the present as a month into the future. So, we did not replicate the future asymmetry found by Caruso et al. (2013) in their experiment 1a with Americans nor the future asymmetries found by Gan et al. (2017) with Chinese participants (in various temporal distances, including one month). The present results are also inconsistent with the asymmetry observed in the UK adults (as well as adolescents and children) by Burns et al. (2019). Our data from the rest of the cultures constitute six additional independent replications where we found no asymmetry.

When all data were pooled together, present results provide a statistically powerful test: there was no asymmetry in temporal distance. Thus, our data question the Temporal Doppler Effect, joining other failures of replication (Ji et al., 2019). Studies of how forward motion affects this asymmetry have also provided conflicting results (Aksentijevic & Treider, 2016; Liefgreen et al., 2020; Loeffler et al., 2017).

One possible interpretation that integrates most of the present findings is that the asymmetry between past and future is a small effect that becomes stronger when longer temporal intervals are considered. As shown, the greatest future asymmetry was found in self-continuity, where participants had to think over a 10-years interval; the asymmetry in temporal depth was only found in the long term; and we did not observe any significant temporal asymmetry when the participants judged a temporal distance of one month. Although it is difficult to bring the time discounting task to bear on this question because it conflates temporal intervals with monetary amounts, it is suggestive that we observed a small asymmetry in this task whose maximum interval is roughly two months and a half. This interpretation is in line with Rutt and Lóckenhoff's (2016) data from implicit measures of self-continuity, which showed that the longer the temporal distance in implicit self-continuity (from 1 month to 10 years), the greater the future asymmetry (however, explicit self-continuity showed symmetry). This interpretation integrates present findings and, possibly, other findings in the literature, providing some support for the dominant view: there is a future asymmetry in temporal thought, though small and only observable under conditions involving long intervals. This possibility can be directly tested in future studies that manipulate temporal magnitude within each of the tasks.

Positive versus negative relation between past and future

The past and future versions of all the temporal tasks in all cultures were positively correlated, regardless of whether or not there was asymmetry, supporting the idea that past and future have a positive relation in the mind. This contradicts the temporal motion interpretation that Caruso et al. (2013) provided for the Temporal Doppler Effect: if the future asymmetry arises because of the forward motion of ego along the mental time line from past to future, as the distance to a future event decreases, the distance to a past event increases. The positive relation between past and future is also unexpected from the Temporal Focus Hypothesis under the assumption that resources used to pay attention and think about the past and the future are limited. To the contrary, the present results show clearly that past and future are positively related in the mind. There is some prior

consistent evidence about the positive relation between the past and future in temporal depth (Bluedorn, 2002), self-continuity (Ji et al., 2019), and time discounting (Kvam et al., 2021; Molouki et al., 2019). The fact that this positive correlation arises in all the temporal tasks suggests that it reveals an organizing principle of temporal cognition and is consistent with approaches such as Ji et al. (2009, 2019), which suggests that people (and cultural groups) vary in the attention they pay to temporal context, both past and future, versus the present.

Cross-cultural temporal focus and temporal asymmetries

We measured temporal focus in two different ways: as the balance between values of past (tradition) and future (progress) and as the amount of attention and thinking devoted to the personal past and future. Either way, we found very little evidence in support of the idea that cross-cultural differences in temporal focus can affect temporal asymmetries in most tasks. We only found an effect of temporal focus on time discounting when cultures with qualitatively different temporal focus were pooled together, thus allowing a statistically powerful contrast. This effect took the expected shape regarding value temporal focus: cultures with future focus showed future asymmetry in time discounting whereas cultures with past focus showed symmetry (although there was not a reversal). However, it took an unexpected shape when considering personal temporal focus: past focused cultures showed future asymmetry whereas cultures with neutral focus showed symmetry. In the correlational analyses at the individual-level, only value temporal focus correlated with time discounting over both the whole sample and in Serbs.

All in all, present results open new and important questions. An important finding of the present study is that the two operationalizations of temporal focus (temporal values vs. personal past-future) behaved in contrasting ways. The cultures in which people gave more importance to traditional values (vs. progress) also devoted more attention to their personal future (vs. past). The present study is the first, to our knowledge, that allows a direct comparison of both measures of temporal focus, and the results suggest that they capture two different kinds of temporal focus. Thus, our results call for a deeper study of the two kinds of temporal focus, which so far were implicitly considered to be alternative ways to measure the same construct.

The contrast between these two measures of temporal focus may offer some help in reconciling some prior results. In our data, Americans were more future-oriented than Chinese in personal temporal focus, U=3170.5, p<.001, $r_{rb}=.-.31$, 95% CI [-. 45, -.16],

but Chinese participants were more future-oriented than Americans in value temporal focus, U=9227.5, p<.01, $r_{rb}=.21$, 95% CI [.07, .34]. As present results show, this may affect different temporal tasks in divergent ways. Although it is an open question whether this possibility will prove valuable, what clearly follows from present data is that researchers should clarify what kind of temporal focus they are talking about, and that they should refrain from assuming that a culture has a certain kind of temporal focus on an a priori basis.

One versus multiple underlying dimensions of temporal cognition

Finally, the present study does not support the idea that the different temporal tasks tap onto the same underlying construct: There was a lack of correlation between the asymmetry indexes in the different temporal tasks, both overall and in the culture-wise analyses (with only three exceptions in the Chinese), and no common factor was found in the exploratory factor analysis. The selected tasks seem to rely on different underlying dimensions of temporal thought that are not constrained to covary. This adds to recent research that has shown that even just one of the dimensions, self-continuity, can be divided into different factors (Bixter et al., 2020). More research is needed to reveal the underlying structure of temporal cognition and how it is captured by different tasks.

Conclusions

The present study undertook an examination of unprecedented breadth of the question of temporal asymmetry and its relation to temporal focus across cultures by using a battery of four temporal tasks and empirically measuring temporal focus in two different ways in eight cultural groups, from Western to Middle Eastern to East Asian, varying widely in temporal focus and amounting to a total sample size of over 1000 participants. We obtained evidence for some important generalizations about temporal thought. First, people around the world think asymmetrically towards the future (vs. the past). This effect varies widely in size across tasks, possibly depending on the length of the temporal distances used in the task. Second, in all tasks and cultures, temporal thought about the past is positively linked to thought about the future. Third, cross-cultural and individual variations in temporal focus do not have an effect on temporal asymmetries, with the only exception of time discounting. Fourth, more research is needed on the construct of temporal focus, which may dissociate into two (perhaps more) different kinds. Finally,

temporal thought is a multi-faceted phenomenon and different tasks may tap onto different underlying dimensions. All in all, present findings pose an important challenge to temporal motion and temporal focus accounts. As in most prior studies, these conclusions are limited to young participants, mostly university students, and further research is needed to establish their wider generality.

Acknowledgments and funding

Acknowledgments. We wish to thank the anonymous reviewers for their valuable comments that have improved earlier versions of this manuscript.

Data availability and open science practices statement. All materials, datasets, and a script with detailed explanatory comments for the statistical analyses (developed in R version 4.1.1, see R Core Team, 2021) of the study reported in this paper are publicly available at Open Science Framework (<u>https://osf.io/bwt5r/</u>). The present work is fully reproducible using those materials.

Author Contributions. All the authors assisted in study design and data collection, and provided critical revisions to the manuscript. The first and the last authors analyzed and interpreted the data and drafted the manuscript. This work is part of the doctoral dissertation of the first author under the supervision of the last author in the Psychology Doctoral Program at the University of Granada.

Conflict of Interest. The authors declare that they have no conflict of interest.

Funding Information. This research was supported by Grant N° PSI2015-67531-P from the Spanish Ministry of Economy and Competitivity to Julio Santiago (PI), Daniel Casasanto, Tilbe Göksun, Alexander Kranjec, Joseph Lavallee, Marc Ouellet, and Slavica Tutnjević, as well as by a predoctoral contract (BES-2016-076717) to Carmen Callizo-Romero.

Supplementary materials

Tables

Table V.S1

Table Showing the Studies, Samples, Tasks, and Results Obtained in the Previous Literature Regarding Temporal Symmetry / Asymmetry in the Following Dimensions: Self-Continuity, Time Discounting, Time Distance, and Temporal Depth

	Future Asymmetry	Past asymmetry	Symmetry
S E L F C O N T I N U I T Y	 Quoidbach et al. (2013) (¬*). Temp. Range in task: 10 years. Studies 1 (N=7519), 2 (N=2717), 3 (N=7130): N=7519 adults (age range 18-68). Rutt & Löckenhoff (2016): (¬*) Implicit measure. Temp. Range in task: 6 time points from 1 month to 10 years. Asymmetry found as the time distance increased (N=91, Mage=50.15, 84% White). Guo & Spina (2019) in British. (¬*). Study 1. Temp. Range in task: 10 years (British, N=76, Mage = 20.34); study 2a and 2b, Temp. Range in task: 10 years (British, N= 82, Mage: 22.28); study 3: Temp. Range in task: 1 year, (British, N=48, Mage=22.31. 	- Ji et al. (2019): Study 3 (*) Temp. Range in task: 4 month. Asymmetry found when pooling together Chinese (N=120, Mage=19.98) and Euro- Canadians (N=79, Mage=18.95); study 4: (*) Temp. Range in task: 1 year. Asymmetry found when pooling together Chinese (N=121, Mage=20.12) and Euro- Canadians (N=105, Mage=19.43).	- Molouki et al. (2019) (*) Temp. Range in task: 1 year. Studies 2a (N =205, Mage=35.5) and 2b (N =200, Mage=33.6) - Rutt & Löckenhoff (2016) (*) (**). Temp. Range in task: 6 points from 1 month to 10 years (N = 91, Mage= 50.15, 84% White). - Guo & Spina (2019) (¬*) Study 1. Temp. Range: 10 years (N = 99, Chinese); Study 2a: Temp. Range: 10 years, and 2b: Temp. Range: 1 year (Chinese, N=135, Mage= 18.95); Study 3. Temp. Range: 1 year (Chinese, N =66, Mage = 19.70).
T I M E D I S C O	-Molouki et al. (2019): (\neg^*) 20 points with a fixed gain (\$10) or loss (\$5) at a distant time point of 1 year in the future or 1 year in the past, depending on condition. Study 1a (<i>N</i> =184, <i>Mage</i> =32); study 1b (<i>N</i> =186; <i>Mage</i> =35.1).	-Kvam et al. (2021). Past asymmetry when payoffs are low and when temporal distance is large.	 Yi et al. (2006) (*¬), magnitude of the delayed amount (\$10 or \$1,000), and 6 temporal distance from 1 day, to 5 years (<i>N</i>=27, <i>Mage</i>=19.9, in USA). Stieg & Dixon (2007) (¬*)

U	- Kvam et al. (2021). (¬*) Task		Fixed delayed reward of
Ν	measuring temporal value		\$1000, opposing
Т	asymmetry. 8 levels of payoffs		immediate rewards from
Ι	(from \$11, to \$1,000,000) and 8		\$1000 to \$10 at delays
Ν	levels of delays (from 7 days to		from 1 week to 10 years
G	730 days). Future asymmetry		(N=8 Texas Hold'em
	when payoffs are high and		Gamblers, Mage=21.1).
	when temporal distance is small		
	(N=67, Mage= 27.4;		- Bickel et al. (2008) (¬*)
	participants from UK. USA.		$(N_{1}) = 30, Mage = 38.5;$
	Europe, Canada and Chile).		N2=29. $Mage=31.86$):
	,F.,		three standard magnitudes
		Related	(\$10, \$100, and \$1000) at
	Related dimension:	dimension: Guo	each of 7 delays to that
	- Guo et al. (2012) (\neg^*)	et al. (2012)	option (from 1 day to 25
	Returning a favour task. Study	Study 1a	vears).
	1a (vacation) and 1 b (iob)	(vacation) and 1	<i>y</i> = === <i>y</i> =
	Temp. Range: 1 month (<i>N</i> =99.	b (iob) (<i>N</i> =88.	
	Mage=29.29. European	Chinese.	- Molouki et al. (2019).
	Canadians); Study 2 Temp.	<i>Mage</i> =19.30).	task measuring temporal
	Range: 2 weeks $(N=97,$	0 /	value asymmetry. Study 2a
	European Canadians); Study 3:		(N=205, Mage=35.5).
	future focus- induction (N=185,		
	<i>Mage</i> =18.19, Canadians;		- Pope et al. (2019)
	<i>N</i> =194, <i>Mage</i> =19.02, Chinese).		(N1=70, N2=70) (¬*) 5-
			trial adjusting delay task
	- Quoidbach et al. (2013). Study		between \$1,000 temporally
	4 (<i>N</i> = 170, <i>M</i> = 34.9).		distant in the past or future
			and \$500 now.
Т	- Caruso et al (2013): Temporal		- Ji et al. (2019). Study 1 b
Ι	Distance Scale. Study 1 (**,		(*) Temp. Range in task: 1
Μ	N=95, Americans); study 2 (*)		year. (N=93, <i>Mage</i> =19.74,
E	Temp. Range in task: 1 year		Chinese; and $(N=80,$
	(N=98, participants in Boston)		Mage=18.06, Euro-
D	Massachusetts); study 3 (*)		Canadian)
Ι	Thinking about an event		
S	(<i>N</i> =325).		
Т			
А	- Gan et al. (2017) Chinese		
Ν	student participants and		
C	temporal axis paradigm in all		
E	studies. Various temporal		
	distances, including one month.		
	Study 1 (<i>N</i> =139, <i>Mage</i> =19.75);		
	Stud2 2 (<i>N</i> =143, <i>Mage</i> =19.78);		
	Study 3 (<i>N</i> =147, <i>Mage</i> =20.08).		
	-Burns et al., 2019 (*) (\neg *)		
1	thinking about an events.		

	versions adapted to each age group. Study 1 (<i>N</i> =491, age range 6-15 years old); study 2a (<i>N</i> =234, age range 6-10 years old); study 2b (<i>N</i> =662, <i>Mage</i> =16.1); study 3 (<i>N</i> =281, <i>Mage</i> 5.3).	
T. D E P	-Bluedorn (2002): Temporal Depth Scale (*) (N=362, Mage=20.83, at University of	
T H	Missouri-Columbia).	

Note: the asterisks have the following meaning: * = we used one version of this task, ** = we used the same task, $\neg * =$ we used a different task to measure the same temporal dimension. The sample's size, mean age and origin are shown whenever indicated in the original study. If the task is not the same as the one used in our work, the main task's characteristics are indicated.

Table V.S2

Mean, Average, SD, and IQR of the Self Continuity Scale, Time Discounting Task, and Time Distance Scale Scores in Both the Past and Future Versions in Each Culture

	Culture	Self- Cont. Past	Self- Cont. Future	T. Disc. Past	T. Disco. Future	T. Dist. Past	T. Dist. Future
Mean	Serbs	3.30	4.00	6.09	5.83	2.43	2.69
	Chinese	3.72	3.94	7.43	10.0	2.81	2.93
	Moroccans	3.16	3.26	5.99	5.39	2.17	2.24
	Croats	3.63	4.83	6.78	6.69	2.47	2.54
	Spaniards	3.31	4.36	8.08	8.74	2.52	2.68
	Turks	3.29	4.25	8.33	8.01	2.36	2.45
	Bosniaks	3.31	4.09	5.70	6.00	2.78	2.80
	Americans	3.51	4.35	10.0	10.0	2.86	2.80
Median	Serbs	3.00	4.00	5.00	5.00	2.00	3.00
	Chinese	4.00	4.00	6.00	10.00	3.00	3.00
	Moroccans	3.00	3.00	5.00	5.00	2.00	2.00
	Croats	4.00	5.00	6.00	7.00	2.00	3.00
	Spaniards	3.00	5.00	8.00	8.00	2.00	3.00
	Turks	3.00	5.00	7.00	7.00	2.00	2.00
	Bosniaks	3.00	4.00	4.00	4.00	3	3.00
	Americans	3.00	4.00	9.00	9.00	3.00	3.00
Standard Deviation	Serbs	1.66	1.50	4.95	4.34	1.16	1.06
	Chinese	1.36	1.30	5.81	5.55	1.17	1.08
	Moroccans	1.88	1.88	5.52	4.46	1.26	1.26

	Croats	1.77	1.61	5.25	4.67	1.07	1
	Spaniards	1.36	1.40	5.20	4.84	1.14	0.97
	Turks	1.47	1.56	6.04	5.17	0.99	0.92
	Bosniaks	1.89	1.59	5.77	5.63	1.23	1.00
	Americans	1.36	1.42	5.94	5.40	1.11	1.06
IQR	Serbs	2.00	2.00	5.00	5.00	1.00	1.00
	Chinese	2.00	2.00	8.00	8.00	1.00	2.00
	Moroccans	3.00	3.00	6.50	5.50	2.00	2.00
	Croats	3.00	2.00	7.00	8.00	1.00	1.00
	Spaniards	2.00	2.00	7.50	7.00	1.00	1.25
	Turks	3.00	3.00	7.00	6.00	1.00	1.00
	Bosniaks	2.75	2.00	7.00	8.75	2.00	1.00
	Americans	1.25	2.25	8.00	7.00	2.00	2.00

Table V.S3

	Culture	T. Depth Short Past	T. Depth Short Future	T. Depth Mid Past	T. Depth Mid Future	T. Depth Long Past	T. Depth Long Future
Mean	Serbs	271	260	861	896	2663	2987
	Chinese	30.1	55.4	180	485	847	1848
	Moroccans	180	152	852	656	3094	2729
	Croats	181	212	796	804	3161	3776
	Spaniards	63.1	56.5	311	297	1366	1297
	Turks	68.9	118	367	621	1750	2371
	Bosniaks	194	223	694	830	2487	3111
	Americans	91.6	100	443	491	1611	1632
Median	Serbs	30.0	30.0	365	365	1825	1825
	Chinese	7.00	14.0	90.0	90.0	365	1095
	Moroccans	30.0	30.0	365	365	2190	2008
	Croats	30.0	30.0	365	180	2190	1825
	Spaniards	14.0	10.5	120	90.0	730	730
	Turks	21.0	14.0	150	180	1095	1460
	Bosniaks	30.0	30.0	365	210	1825	1825
	Americans	10.5	7.00	180	165	730	730
Standard Deviation	Serbs	903	919	1647	1761	4147	4149
	Chinese	61.5	162	235	1161	974	2486
	Moroccans	317	293	1193	768	3415	2710
	Croats	386	566	1014	1451	4537	5030
	Spaniards	140	147	485	509	1411	1625

Mean, Average, SD, and IQR of the Temporal Depth Task Scores in Both the Past and Future Versions in Each Culture

	Turks	203	328	514	1104	1796	2698
	Bosniaks	467	503	1066	1282	4103	4789
	Americans	343	277	1636	1178	4928	2235
IQR	Serbs	173	173	1081	1035	3213	3285
	Chinese	27.0	23.0	178	335	913	3285
	Moroccans	196	143	1065	1065	2920	3148
	Croats	173	173	1005	989	2920	2920
	Spaniards	35.1	23.0	335	335	1460	1460
	Turks	45.5	46.0	335	670	3103	3285
	Bosniaks	173	173	670	1065	3285	3285
	Americans	34.3	53.0	335	335	1460	1460

Table V.S4

Mean, Average, SD, and IQR of Temporal Focus Questionnaire and Temporal Focus Scale Scores in Both the Past and Future Versions in Each Culture

	Culture	TFS Past	TFS Future	TFQ Past	TFQ Future
Mean	Serbs	3.44	3.91	3.60	3.14
	Chinese	3.62	3.45	2.83	3.16
	Moroccans	3.32	3.93	3.60	3.43
	Croats	3.44	3.94	3.50	3.24
	Spaniards	3.61	3.71	2.74	3.32
	Turks	3.79	3.91	2.67	3.26
	Bosniaks	3.41	3.94	3.47	3.24
	Americans	3.71	4.10	3.09	3.16
Median	Serbs	3.25	3.88	3.70	3.20

	Chinese	3.75	3.50	2.85	3.20
	Moroccans	3.25	4.25	3.60	3.50
	Croats	3.50	4.00	3.60	3.20
	Spaniards	3.63	3.75	2.70	3.30
	Turks	3.88	4.00	2.72	3.22
	Bosniaks	3.50	4.00	3.50	3.20
	Americans	3.75	4.00	3.10	3.20
Standard Deviation	Serbs	0.83	0.580	0.67	0.56
	Chinese	0.88	0.773	0.40	0.45
	Moroccans	1.09	0.94	0.78	0.60
	Croats	0.85	0.67	0.75	0.511
	Spaniards	0.69	0.62	0.65	0.44
	Turks	0.89	0.76	0.74	0.58
	Bosniaks	0.89	0.77	0.67	0.46
	Americans	0.77	0.54	0.69	0.43
IQR	Serbs	1.19	0.750	0.70	0.60
	Chinese	1.06	1.00	0.50	0.70
	Moroccans	1.75	1.50	1.10	0.75
	Croats	1.25	0.75	0.93	0.70
	Spaniards	0.75	0.813	0.73	0.60
	Turks	1.25	0.813	1.17	0.72
	Bosniaks	1.25	1.00	1.00	0.70
	Americans	1.25	0.75	0.90	0.60

Figures

Figure V.S1

Bar Graphs Representing the Effect Size of Asymmetry Indexes Computed for Each Task in Each Culture Ordered From Future-Focused (Left) to Past-Focused (Right) According to Temporal Focus Scale index: (A) Self-continuity Scale; (B) Time Discounting Scale; (C) Temporal Distance Task; (D) Temporal Depth Task



Note. Effect sizes are calculated by Rank-Biserial Correlation. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: *** p < .001



CHAPTER VI: STUDY 4

OUTSTANDING ISSUES ON TIME ASYMMETRY⁹

⁹ The content of this chapter are three empirical studies in preparation. Here I show the results of the preliminary analyses. This content can be referenced as :

Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022b). *Personal and value temporal focus, religiosity, and temporal asymmetry* [Manuscript in preparation]. Department of Experimental psychology, University of Granada.

Highlights (in relation to research goals):

- The personal temporal focus did not vary during the pandemic across cultures (in relation to research goal #1.4).

- The personal temporal focus was not related to time spatialization (in relation to research goal #2.1 and 2.2).

- The increase in value temporal focus during the pandemic was only related to the temporal asymmetry in time discounting. We found no other changes in the temporal asymmetry due to the arrival of the pandemic (in relation to research goal #3.5).

- The greater the religiosity, the greater the traditionalism (i.e., the lower the value temporal focus index) but the greater the future personal (i.e., the higher the personal temporal focus index). We explained this finding in the framework of the Uncertainty Hypothesis (in relation to research goal #1.5).

CHAPTER VI OUTSTANDING ISSUES ON TIME ASYMMETRY

Throughout the first three main studies of the dissertation (shown in Chapters III, IV, and V) the effect of the value temporal focus, personal temporal focus, and religiosity on temporal asymmetries in several dimensions both before and during the pandemic was studied. However, there are some relationships between these dimensions that were not addressed because the studies were developed to answer more specific research questions, so the following issues remained unresolved: 1) the role of personal temporal focus on time spatialization before and during the pandemic; 2) the effect of the pandemic on temporal asymmetries in time distance, self-continuity, time discounting, and temporal depth; and 3) the dissociation of the two temporal foci and their relation to religiosity.

The data from previous studies (excluding the data that other authors generously shared with us to study time spatialization in Chapter III; see Bylund et al., 2020; Gu et al., 2019; Li & Cao, 2017; Li et al., 2018) came from a global dataset in which all temporal dimensions were measured in all cultures both before and during the pandemic. So were able to address these unresolved questions and get a broad picture of how factors that can modulate our attention to the past and the future (value temporal focus, personal temporal focus, and religiosity) relate to each other and exert a role on perceived temporal asymmetry (in spatialization, distance, self-continuity, discounting, and depth), as well as their possible transformation during the social crisis of the COVID-19 pandemic. In this section, we presented the studies we conducted to address such matters.

Personal temporal focus and time spatialization

Introduction

In Chapters III and IV, we showed the effect of the value temporal focus on temporal spatialization before and during the pandemic, respectively. We used only this measure of temporal focus (and not the personal temporal focus) since we only had a sufficient number of groups to make the predictive model (developed in Chapter III) with that measure, given that in addition to the eight samples we collected, we used the samples that de la Fuente et al. (2014) had previously collected from our research group (who only used value temporal focus as measure of temporal focus).

However there is also extensive literature showing an effect of personal temporal focus on the proportion of locating the future in front (see Li, 2021; Li & Cao, 2018a; 2018b; 2019; 2021b). In the present study, we tested whether or not personal temporal focus has an effect on temporal spatialization with the samples collected in our database both before and during the pandemic.

We followed a procedure parallel to the one developed in Chapter III and Chapter IV to study the effect of temporal value focus on temporal spatialization. First, we studied the effect of temporal value focus on the proportion of future in front with the sample collected before the pandemic, grouping people by their culture. Second, we studied whether or not the changes in temporal spatialization shown during the pandemic (see Chapter IV) were associated to changes in personal temporal focus across the culture clusters.

Before the pandemic arrival

Materials and methods

We used the data from the samples described in Chapter V (Americans, Bosniaks, Chinese, Croats, Moroccans, Serbs, Spaniards, and Turks) collected before the pandemic, in their responses to the Temporal Diagram Task (see description in Chapter III) and the Temporal Focus Scale (which is the scale for measuring the personal temporal focus, see description in Chapter V), which resulted in a total of 810 participants.

Results

We performed generalized linear mixed models using the binomial family and a logit link, and we started by centering and scaling the overall mean of the personal TF (the predictor). We performed a null model containing only the overall intercept, df = 1, AIC = 1,418; then a second model including random intercepts by group, df = 2, AIC = 1,425.6; then a third model adding individual TF as a fixed effect, df = 5, AIC = 1,091.3; and then a fourth model adding to the random term the random slopes of the personal temporal focus within each group, df = 4, AIC = 1,095.9. Finally, we ran a model without any random term that included only TF as a fixed effect, df = 2, AIC = 1,084.9. The model without any random term provided the best AIC, so I kept it. However, neither this model, $\beta = 0.42$, OR = 1.52, 95% CI [0.60, 3.87], nor any of the other models revealed a significant effect of *personal* TF on the proportion of a future-in-front response (in all cases the OR value was between the 95% CI).

During the pandemic

Materials and methods

We used the data of the cultural clusters collected both before and during the pandemic (see description of the participants in Chapter IV), in their responses to the Temporal Diagram Task (see description in Chapter IV) and the Temporal Focus Scale (see description in Chapter V). The sample sizes for each cluster in each measure in the sample collected both before and during COVID-19 are shown in Table VI.1.

	PRE-COVID19		COVID19	
Culture	Progress-	Tradition-	Progress-	Tradition-
cluster	oriented	oriented	oriented	oriented
Future-	376	416	606	215
in-front	570	-10	000	215
Personal	284	336	579	205
TF I	201	550	517	205

Table VI.1Sample sizes in Each Group
Results

A linear model showed that there was no effect of being tested before or during the pandemic (i.e., the COVID-19 variable), F(1) = 0.5, p = 0.48, nor interaction of this effect with being from a traditional (and oriented to the personal future) or progressive (and balanced between attention paid to the personal past and future; i.e., the Cluster variable) on personal temporal focus, F(1) = 1.73, p = 0.2.

General discussion

The results showed that that unlike the *value* temporal focus (as shown in Chapter III), *personal* temporal focus was not related to temporal spatialization in the sample collected before the pandemic. In addition, variations in time spatialization during the pandemic were not accompanied by variations in the temporal staff focus, while they did in the value temporal focus (Chapter IV). These results contrast with previous studies showing an effect of *personal* temporal focus on time spatialization (see Li, 2021; Li & Cao, 2018a; 2018b; 2019; 2021b). How can this be interpreted?

One possibility is that *value* temporal focus mainly shows variability between cultures while *personal* temporal focus mainly shows individual differences (Germano & Brenlla, 2022; although personal temporal focus could also be influenced by countrylevel dimensions). Thus, *personal* temporal focus could be a better predictor of time spatialization when studying individual differences between people from the same country, especially when the overall personal temporal focus index in that country is balanced between the attention paid to the past and to the future, as in China (see Figure V.7). This interpretation fits with the fact that all the evidence shown in previous literature testing the TFH and using the *personal* temporal focus (Li, 2021; Li & Cao, 2018a; 2018b; 2019; 2021b) have been collected in China contrasting groups of people who were expected to be more past- versus future-oriented in their personal temporal focus due to individual differences (e.g., for being pregnant, more or less conscientious, having different political attitudes, or dispositional optimism). Therefore, we propose that value temporal focus may reflect primarily cultural differences whereas personal temporal focus may reflect mainly individual differences as an explanation of this pattern of results. Future cross-cultural studies using both indexes of temporal focus are needed to clarify the issue.

Temporal asymmetries in time distance, self-continuity, time discounting, and temporal depth during the pandemic

Introduction

In Chapter IV we showed that the pandemic could cause young people to increase their value temporal focus toward the future (progressive values). Since value temporal focus does not seem to affect most asymmetries (Chapter V) we did not expect to find that a change in value temporal focus would be accompanied by changes in temporal asymmetries, except for a possible change in time discounting: namely, that people during the pandemic (vs. before) choose in a greater extent a larger but farther away reward in the future than in the past. We tested this possibility in the present study.

Materials and methods

First, we ran linear models to study whether or not there was an effect of the COVID-19 variable (being from a sample collected before versus during the pandemic) or of the interaction of the COVID-19 variable with the Cluster variable (being from a cluster that before the pandemic was oriented to progress versus tradition) to explain the temporal asymmetry indexes. As shown in Chapter V, the cultures were divided into cultural clusters.Regarding value temporal focus, we found that Spaniards, Chinese, and Turks were oriented to values related to the future (e.g., progress; and they were also less religious than the group average), while Moroccans, Bosniaks, Croats, and Serbs were oriented to values related to the past (e.g., tradition; and they were also more religious than the group average). Americans showed a balance between progressivism and traditionalism (and their level of religiosity was similar to the overall mean).

Second, we tested whether or not the indexes that measure the psychological impact of the COVID-19 pandemic (see a description in Chapter IV) were correlated with the indexes of temporal asymmetry during the pandemic. For this, we used the sample of participants described in Chapter IV.

Results

Comparison of temporal asymmetries before the pandemic versus during the pandemic

The sample sizes for each cluster in each asymmetry index in the sample collected both before and during COVID-19 are shown in Table VI.2.

Table VI.2

Sample sizes for Each Group

	PRE-COVID19		COVID19	
Culture cluster	Progress- oriented	Tradition- oriented	Progress- oriented	Tradition- oriented
Self- Cont. Index	283	335	601	220
T. Discount. Index	280	306	588	210
T. Distance Index	284	336	585	217
T. Depth Short I	320	343	519	181
T. Depth Mid I	320	343	519	181
T. Depth Long I	320	343	519	181
T. Depth SD I	320	343	518	181

We did not find an effect of the COVID-19 variable on the asymmetry indexes (time distance index, self-continuity index, time discounting index, and temporal depth index), nor the interaction between the COVID-19 variable and the Cultural cluster variable except on the time discounting index, F(1) = 9.49, p = .002. Specifically, only the tradition-oriented cluster during the pandemic (compared to before the pandemic) discounted less a reward in the future (versus the past; i.e., chose higher delayed rewards in the future than in the past) as revealed by a post hoc analysis, t = 2.56, p = .04. We found no other statistically significant effect in the post hoc comparison.

Psychological impact of COVID-19 and the perceived temporal asymmetries

Table VI.2 shows *Kendall's Tau-B* Correlation Coefficients between the COVID-19 indexes (overall, personal, and social; see a description in Chapter IV) with the

asymmetry indexes in the sample of participants collected during the pandemic (see sample sizes also in Table VI.2).

As shown, we found no statistically significant correlation (with the exception of the correlation between the COVID-19 indexes with the value temporal focus index that was already shown in Chapter IV). We also found no significant correlation between the asymmetry indexes with each other during the pandemic, except for a correlation between the value temporal focus index and the self-continuity index.

Table VI.2.

Kendall's Tau-B Correlation Coefficients Between the COVID19 Indexes (overall, personal, and social) and the asymmetry indexes during the pandemic.

		COV. Over I	COV. Pers. I	COV. Social I	Self- cont. I	T. Disc. I	T. Dist. I	T. Depth Short I	T. Depth Mid I	T. Depth Long I
Self- C. I	ТаиВ	0.05	0.04	0.05						
0.12	Ν	849	849	849						
T. Disc I	ТаиВ	-0.04	-0.05	-0.03	0.01					
	Ν	825	825	825	825					
T. Dist I	ТаиВ	-0.04	-0.05	-0.01	0.03	0				
	Ν	828	828	828	826	821				
T. Depth short I	TauB	-0.05	-0.04	-0.06	-0.04	0.01	0.01			
	Ν	718	718	718	718	718	718			
T. Depth mid I	ТаиВ	-0.05	-0.04	-0.05	-0.04	0.06	0.04	0.47 ***		
	Ν	718	718	718	718	718	718	718		
T. Depth long I	ТаиВ	-0.01	0	-0.02	-0.05	0.03	-0.01	0.32 ***	0.45 ***	
	Ν	718	718	718	718	718	718	718	718	
T. Depth SD I	ТаиВ	-0.02	-0.01	-0.02	-0.04	0.03	-0.01	0.19 ***	0.33 ***	0.87 ***
	Ν	717	717	717	717	717	717	717	717	717
Pers. TF I	ТаиВ	-0.04	-0.04	-0.02	0.03	0.03	-0.05	0.01	0.03	0.02
	Ν	808	808	808	808	808	808	717	717	717
Value TF I	ТаиВ	0.09 ***	0.08 **	0.09 ***	0.09 ***	-0.02	0.02	-0.02	-0.02	-0.03
	Ν	802	802	802	802	802	802	712	712	712

General discussion

These results supported the prediction: the increase in value temporal focus during the pandemic did not affect the pattern of temporal asymmetry (shown in Chapter V) except that the tradition-oriented cultural cluster increased both its future focus and future asymmetry in time discounting during the pandemic. This supported the evidence regarding the relationship between value temporal focus and asymmetry in time discounting found in Chapter V. However, we did not find a statistically significant correlation between these two variables at the individual level during the pandemic.

The dissociation of the two temporal foci across cultures and their relation to religiosity

Introduction

As shown above and in Chapter V, the samples collected before the arrival of the COVID-19 pandemic can be divided into cultural clusters in which value and temporal person foci are dissociated. Here we proposed that this dissociation can be explained by religiosity and perceived economic insecurity, in the context of the Uncertainty Hypothesis (Barber, 2011).

The Uncertainty Hypothesis (Barber, 2011) proposes that religiosity is higher in individuals and countries with a weak, unstable, uncertain, and unpredictable economy, while it is lower in countries and individuals where the economy is stronger and more stable since religion offers psychological security in an unstable environment or conditions. Consistently with prior findings (Saroglou et al., 2003; Schwartz & Huismans, 1995), we observed that religiosity is associated with traditionalism, so people with a lower and unstable economy are likely to have a *value* temporal focus on the past. At the same time, these people might have a *personal* temporal focus on the future, because they are worried about their future due to the situation of greater economic instability, insecurity, and uncertainty they live in. According to the uncertainty hypothesis, at the group level, people in our sample from cultures of countries with lower GDP per capita should be more religious and traditional than people from countries with higher GDP. Moreover, if this speculation is correct, at the individual level, religiosity should correlate negatively with value temporal focus (as shown in Chapter V) and positively with the personal temporal focus index (which is still unknown). In the present study in progress we aimed to test these predictions.

Materials and methods

We used the data from the sample of participants collected before the pandemic that is described in Chapter V. In particular, we used the variables of value temporal focus and personal temporal focus (see description of these variables and the instrument used to measure them in Chapter V) as well as religiosity (see a description in Chapter IV). We also used the GDP per capita indexes offered by The World Bank (2021).

Results and discussion

The predictions were confirmed by the results. At the group level, the average of the GDP per capita of the cluster of progress-oriented and low religious countries (Turkey: 10.90, China: 8.09; Spain: 26.52; total average = 15.71) was higher than that of the tradition-oriented and highly religious countries (Bosnia-Herzegovina, where Serbs, Croats, and Bosniaks are located: 5.00; and Morocco: 2.9; total average = 3.95). At the individual level, Kendall's *Tau-B* Correlation Coefficients showed that religiosity correlated negatively with the value temporal focus index (N = 1064; $\tau b = -.35$, p < .001), as we had already shown (Chapter IV) and positively with the personal temporal focus index (N = 810; $\tau b = .16$, p < .001).

The correlations between religiosity and the two temporal foci were in line with previous evidence, which shows that religiosity is positively correlated with traditional values (Schwartz & Huismans, 1995) and with having a future time perspective (Łowicki et al., 2018; which is likely to be associated with a future personal temporal focus). These findings also clarify the negative correlation found between the cultural value of openness to change (which is related to progressive values) with the future time perspective (Milfont & Gouveia, 2006). We proposed, in the framework of the Uncertainty Hypothesis, that the dissociation between the two temporal foci can be explained by a feeling of insecurity in countries and individuals with more unfavorable economies. Future research may extend this finding to study the relationship between the socioeconomic level of individuals and their perceived sense of economic security with their religiosity and the two temporal foci.



CHAPTER VII: STUDY 5

TRUST IN TIME. THE RELATIONSHIP BETWEEN RELIGIOSITY, TEMPORAL FOCI, AND TIME MAGNITUDES ACROSS CULTURES¹⁰

¹⁰The content of this chapter is an empirical study in preparation. Here I show the results of the preliminary analyses. This content can be referenced as :

Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022c). *Trust in time. The relationship between religiosity, temporal foci, and time magnitudes across cultures*. [Manuscript in preparation]. Department of Experimental psychology, University of Granada.

Highlights (in relation to research goals):

Religiosity was negatively related to value temporal focus and positively related to personal temporal focus, time discounting, and time horizons across cultures and individuals. This could be explained in the framework of the Uncertainty Hypothesis (in relation to research goal #4.1).
Changes in religiosity and value temporal focus during the pandemic were accompanied by changes in global time discounting and global temporal depth (in relation to research goal #4.2).

CHAPTER VII RELIGIOSITY, TEMPORAL FOCI, AND MAGNITUDES

In Chapter V we examined the existence of an effect of *asymmetry* in the perception of the past *versus* the future in four temporal dimensions (self-continuity, time distance, time discounting, and temporal depth), and their relation to the two temporal foci. But there is still another related issue that can be addressed with our data: the inter-cultural differences in the *global magnitude* of the temporal dimensions (self-continuity, time distance, time discounting, and temporal depth) and their relation to the two temporal foci and religiosity. In this case, we are not investigating temporal *asymmetry*, but averaging the responses to the past and future versions of the temporal tasks to assess changes in magnitude independently of whether they are directed to the past or the future. Thus, for example, an increase in global magnitude in the temporal distance task means that participants perceived longer distances to an event located at a specific temporal distance, disregarding whether the event is in the past or the future.

When studding temporal magnitude we address questions such as: will people from the tradition-oriented cluster (who are more religious and mostly focused on their personal future) have higher values of *global* self-continuity/temporal distance/ time discounting/ temporal depth (i.e., *both* into past and future) compared to people from the progress-oriented cluster (who are less religious and balanced between the attention given to their personal past and future)? Asking this kind of question makes all the sense in view of the finding of strong positive correlations between the responses toward the past and the future in all assessed temporal dimensions (see Chapter V).

In the present studied, we explored the role of temporal focus and religiosity on temporal dimensions across cultures in the framework of the Uncertainty Hypothesis (Barber, 2011). First, we studied the relationship between the temporal foci and religiosity with the magnitude of the temporal dimensions in the global distance, self-continuity, discounting, and depth with the database collected before the pandemic. Second, we studied whether or not the changes in temporal value focus and religiosity during the pandemic were accompanied by changes in the magnitude of the temporal dimensions.

Religiosity, temporal foci, and temporal *global magnitudes* across cultures before the pandemic

Introduction

As shown in Chapter VI, the negative correlation between the two temporal foci with religiosity in people's minds could be explained by a feeling of socio-economic insecurity in the framework of the Uncertainty Hypothesis (Barber, 2011). Here we predicted that this hypothesis could also explain the relationship between religiosity and the two temporal foci with the global magnitudes of temporal dimensions (global self-continuity, time distance, time discounting, and temporal depth) across cultures.

First, an economically stable context could also be related to global self-continuity since self-continuity occurs when there is confidence in the stability of the self over time (Becker et al., 2018). This stability of the self might be greater in contexts where the economy is also stable: if the environment is perceived to be stable and unchanging we will not have to adapt to changes and will have a more stable image of ourselves over time. Previous literature showed cross-cultural differences in global self-continuity (e.g., Chinese reported greater self-continuity and less perceived distance in *both* past and future than Euro-Canadians; see Ji et al., 2019) which was associated with ways of thinking (holistic versus analytic). But, to the best of our knowledge, there is no literature testing a possible effect of the economic context and its relation to temporal foci and religiosity on self-continuity.

Second, a stable economic context could also affect the magnitude of global time distance. Economic stability allows us to be more certain about what the past and future look like and therefore to represent past and future events with a greater level of detail in our minds. Based on Construal Level Theory (Liberman & Trope, 1998; Trope & Liberman, 2003), this could make past and future events to be perceived as closer to the present in contexts of greater economic security. We found no studies testing this possibility in the previous literature.

Third, the temporal dimension that could be most related to the uncertainty hypothesis is global time discounting. Wang et al., (2016) compared samples from 53 countries and showed that individuals with lower discounting rates are from countries with higher GDP, which also were economically more stable and secure and had lower uncertainty avoidance. According to the uncertainty hypothesis, the worse the economic

CHAPTER VII RELIGIOSITY, TEMPORAL FOCI, AND MAGNITUDES

situation, the greater the religiosity (Barber, 2011), which would explain why religious people could discount more than less religious people: because they would need the money as soon as possible and also because, given the economic instability, they do not trust the promise of receiving the delayed future reward. However, other studies showed that religious people seem to discount less because religions encourage delayed gratification (Carter et al., 2012; see also Renneboog & Spaenjers, 2012). As seen, there is mixed evidence in the previous literature on the association between religiosity and time discounting (see Marcus & McCullough, 2021) and more research is needed to clarify this issue.

Fourth, the uncertainty hypothesis could also explain the magnitude of temporal depth. There seems to be agreement that people from traditionalism-oriented (Bluedorn, 2002) and more religious (Renneboog & Spaenjers, 2012) countries have longer horizons than people from progress-oriented and less religious countries, probably because traditionalism and religiosity connect people with periods in the long-term past (i.e., they look back to how ancestors did things) and long-term future (they look forward to a future that even transcends death, i.e., a transcendental future). If this were the case, it might imply that people in countries with more unstable economies (who are presumably more religious and traditional) might be more long-term oriented than those in countries with stronger and more stable economies. However, previous literature showed that people from places with unstable economies are short-term oriented (Preis et al., 2012) as well as discounting more, which is intuitively compelling for the reasons stated above: because the social environment is insecure and there is a risk of not obtaining the greater future reward at all (Barber, 2011), and because the short-term reward is more valuable since it can produce benefits that are needed in the short-term (Mell et al., 2021). Thus, the relationship between the two temporal foci, religiosity, time discounting, and temporal horizons needs to be clarified.

In the present study in progress, we explored the relation between value and personal temporal focus and religiosity, with four temporal dimensions (global selfcontinuity, global time distance, global time discounting, and global temporal depth) across cultures.

Methods

We used the data from the eight cultures collected before the pandemic (Spaniards, Chinese, Turks, Americans, Moroccans; and Bosniaks, Croats, and Serbs from Bosnia Herzegovina; N = 1075; see Chapter V for a description of participants), which are divided into different clusters based on their temporal foci and their level of religiosity: The progress-oriented cluster (Spaniards, Chinese, and Turks) was oriented to values related to the future, had a low religiosity, and was balanced in the attention paid to their personal past and future. The tradition-oriented cluster (Moroccans, Bosniaks, Croats, and Serbs) was oriented to values related to their personal future. The tradition-oriented cluster (Moroccans, Bosniaks, Croats, and Serbs) was oriented to values related to the past, had a high level of religiosity, and was oriented to their personal future. Americans were not bias in their value temporal focus, and their level of religiosity was similar to the overall mean, so they were not included in the cluster division.

First, at the group level, we compared the cultural clusters on the global magnitude of the temporal dimensions (which we computed by averaging the scores in both the past and future versions from the Self-Continuity Scale, Time Distance Task, Time Discounting Scale, and Temporal Depth Task; see task descriptions in Chapter V). The sample sizes for each global magnitude in each cultural cluster in the sample collected both before and during the pandemic are shown in Table VII.1.

Table VII.1

Sample Sizes in Each Group

-Culture cluster	Progress- oriented	Tradition- oriented	
Global Self- Cont.	283	335	
Global T. Discount.	280	306	
Global T. Distance	284	336	
Global T. Depth Short	320	343	
Global T. Depth Mid	320	343	
Global T. Depth Long	320	343	
Global T. Depth SD	320	343	
Personal TF I	284	336	
Value TF I	376	414	
Religiosity I	376	412	

Second, at the individual level, we performed correlations and partial correlations between religiosity, the two temporal foci with global self-continuity, global time distance, global time discounting, and global temporal depth (see sample sizes in Table VII.2).

Results

Figure VII.1 shows the results of the analyses comparing the cultural clusters. The progress-oriented and low religious cluster (Spaniards, Chinese, and Turks) showed a higher rate of choice of farther greater rewards (i.e., they discounted less) and a lower global temporal depth (i.e., they had shorter time horizons) than the tradition-oriented and less religious cluster (Moroccans, Bosniaks, Croats, and Serbs). Likewise the cluster of cultures balanced between orientation to the personal past and future (which are the same as those oriented to progress: Spaniards, Chinese, and Turks) showed a higher rate of choice of farther greater rewards (i.e., they discounted less) and a lower global temporal depth (i.e., they had shorter time horizons) than the cluster of the personal past and future (which are the same as those oriented to progress: Spaniards, Chinese, and Turks) showed a higher rate of choice of farther greater rewards (i.e., they discounted less) and a lower global temporal depth (i.e., they had shorter time horizons) than the cluster oriented to their personal future

(which is the same as tradition-oriented plus Americans: Moroccans, Bosnians, Croats and Serbs, and Americans).

Figure VII.1

Effect Sizes Calculated by Rank Biserial Correlation From Comparing the Cultural Clusters According to the Value Temporal Focus and (B) Personal temporal focus in the Global Magnitude Self-Continuity, Time Discounting, Time Distance, Temporal Depth as well as in the Personal TF, Value TF, and Religiosity.



Note. The error bars show the 95% Confidence Interval of the effect size. Statistically significant results after FDR correction for multiple comparisons are marked with asterisks: *** p < .001.

Positive effect sizes indicate that the clusters of cultures oriented to progress and balanced between their personal past and future (in their personal TF) have higher values on that dimension than the cluster of cultures oriented to tradition (in their personal TF value) and personal future (in their personal TF). Negative values indicate the opposite.

CHAPTER VII RELIGIOSITY, TEMPORAL FOCI, AND MAGNITUDES

As shown in Table VII.2, at the individual level, Kendall's Tau correlations (after applying False Discovery Rate method correction; FDR) showed that religiosity was negatively correlated with the choice of higher delayed rewards (i.e., religiosity correlated positively with global time discounting) and positively correlated with global temporal depth. That is, more religious people discounted more but had longer temporal horizons. We found just the opposite pattern when correlating the value temporal focus index with these global magnitudes: progress-oriented people discounted less and had shorter temporal horizons. The personal temporal focus index was not correlated with any global magnitudes. Finally, no correlations were found between global self-continuity and global time distance and neither of the two temporal foci indexes nor with the religiosity index.

Table VII.2

Kendall's Tau Correlations (after FDR Correction) Between Religiosity, the Two Temporal Foci, and Temporal Dimensions

		Relig. Index	Value TF I	Pers. TF I	Self- Cont.	T. Disc.	T. Dist.	T. Depth Short	1. Depth Mid
Value	Tau B	-0.35 ***							
TF I	Ν	1064							
Pers.	Tau B	0.16 ***	-0.02						
TF I	Ν	810	812						
Self-	Tau B	-0.06	-0.02	-0.05					
Cont.	Ν	811	811	810					
T. Disc.	Tau B	-0.11 ***	0.08 **	0	0.02				
1. Disc.	Ν	736	738	739	737				
T Diet	Tau B	-0.06	0.03	-0.04	0	-0.02			
	Ν	812	812	811	812	740			
T. Depth	Tau B	0.09 ***	-0.03	0.06	-0.01	-0.07 **	-0.14 ***		
Short	Ν	859	859	677	677	629	678		
T. Depth	Tau B	0.09 ***	-0.05	0.06	-0.02	-0.05	-0.16 ***	0.64 ***	
Mid	Ν	850	850	671	671	625	672	848	
T. Depth	Tau B	0.12 ***	-0.08 ***	0.07	-0.02	-0.06	-0.15 ***	0.41 ***	0.62 ***
Long	Ν	856	857	675	675	630	676	847	846

Note. The multiple correlations from the correlation matrix were corrected by the False Discovery Rate method. Statistically significant results are marked asterisks: ** p < .01, *** p < .001.

Partial correlations at the individual level (after FDR correction) revealed that, when controlled for religiosity, the correlations of the value temporal focus index with global time discounting and global temporal depth were no longer statistically significant. When controlled for both value and personal temporal focus indexes, the religiosity index still significantly correlated with global time discounting, Tb = -.09, p < .001, and with global temporal depth, Tb = .11, p < .001.

Finally, global time distance was negatively correlated with global temporal depth at all time horizons (see Table VII.2), which was still significant after controlling for the religiosity index, value temporal focus index, and personal temporal focus index in the short-term, Tb = -.13, p < .001, mid-term, Tb = -.15, p < .001, and long-term, Tb = -.14, p < .00. These results indicated that the shorter the perceived global temporal distance, the longer the global horizons.

Discussion

We found at the cultural level that the cluster of highly religious cultures (which had a weaker economy, were tradition-oriented, and also oriented towards their personal future) discounted more and had longer horizons than the cluster of low religious cultures (with stronger economy, oriented towards progress and balanced between past and personal future). There were no differences in time distance or self-continuity when comparing cultural clusters. The results at the individual level supported those found at the group level: we found that the greater the religiosity, the greater the orientation to tradition, the greater the orientation to the personal future, the greater the discounting and the greater the temporal depth. We found no statistically significant correlations of religiosity with time distance or temporal self-continuity.

We interpreted the results found in global time discounting and global temporal depth in the framework of the Uncertainty Hypothesis (Barber, 2011). In contexts of economic uncertainty and insecurity and greater religiosity, more discounting occurs because the pressing needs of the present makes immediate money all the more valuable than any farther away money. Furthermore, people living in these contexts of uncertainty are more religious and could have longer horizons, which is characteristic of religious people who are tradition-oriented (see Bluedorn, 2002) probably because tradition connects them with the remote past and religiosity with a very distant future even beyond death (Łowicki et al., 2018).

Finally, temporal focus, religiosity, or socio-economic context were not related to self-continuity, suggesting that a context of economic stability does not imply a view of stability in self-image over time. Nor did we find an effect on perceived temporal distance, suggesting that a more stable economic context does not imply that information about events is represented in greater detail (since if it did, according to Construal Level Theory, these events might feel closer in stable economic contexts; see Liberman & Trope, 1998).

Religiosity, temporal foci, and temporal *magnitudes* across cultures during the pandemic

In Chapter IV we showed that future value temporal focus increased and religiosity decreased in samples collected during the pandemic, compared to samples collected before the pandemic. In the previous section, we showed that religiosity and traditional (versus progressive) temporal focus are positively related to both global time discounting and global time horizons. We here reported preliminary analyses regarding whether the changes observed during the pandemic were accompanied by a decrease in global time discounting and temporal depth across cultural clusters.

To address these issues, we first ran linear models to study the effect of the COVID-19 variable and its possible interaction with the Cultural cluster variable. The sample sizes for each global magnitude in each cultural cluster in the sample collected before and during the pandemic are shown in Table VII.3.

Table VII.3.

Sample Sizes in Each Group

PRE	C-COVID19	COVID-19		
Culture cluster	Progress- oriented	Tradion- oriented	Progress- oriented	Tradion- oriented
Global Self- Cont.	283	335	601	220
Global T. Discount.	280	306	588	210
Global T. Distance	284	336	585	217
Global T. Depth Sho	ort 320	343	519	181
Global T. Depth Mic	a 320	343	519	181
Global T. Depth Lor	ng 320	343	519	181
Global T. Depth SD	320	343	519	181
Personal TF I	284	336	579	205
Value TF I	376	414	576	202
Religiosity I	376	412	573	200

Second, using only the data collected during the pandemic, we examined the correlation between the indexes of psychological impact for the pandemic (see a description of these indexes in Chapter IV) with the global self-continuity, time distance, time discounting, and temporal depth.

Comparison of samples collected before versus during the pandemic

We found an interaction between the COVID-19 and Cultural cluster variables in global time discounting, F(1) = 5.27, p = .022, and in global temporal depth in the short-term, F(1) = 4.94, p = .026. Thus, we observed that during the pandemic (versus before) people from traditional and religious cultures did not change neither in global time discounting nor in global temporal depth while those in the cluster of progress-oriented and less religious cultures showed the following changes: 1) they decreased their global time discounting, thereby increasing the difference between the two cultural clusters in time discounting which reached significance, t = 9.46, p < .00; and 2) they shortened their

overall short-term time horizons (we found no effect on mid- nor long- term horizons), a difference between clusters which was also significant, t = -7.09, p < .001.

We also found a main effect of the COVID-19 variable on global time distance, F(1) = 5.53, p = .02: People in both clusters perceived greater subjective temporal distance to an event located one month away during the pandemic than before the pandemic. Finally, we did not find an effect of the COVID-19 variable nor an interaction of this variable with the Cluster variable in the measure of global self-continuity.

Correlation between religiosity, the two temporal foci, the impact of COVID-19 index, and the magnitude of temporal dimensions during the pandemic

By correlating religiosity, the two temporal foci, COVID-19 indexes, and the magnitude of temporal dimensions during the pandemic, we observed that the greater the impact of the pandemic, the greater the global self-continuity, the longer the global time distance, the lower the global time discounting (i.e., the greater the choice of bigger delayed rewards), and the greater the perceived global temporal (long-term) depth (see Table VII.4).

Table VII.4

Correlation Matrix Between Religiosity, Temporal Foci, COVID-19 Overall Index and the Global Magnitude of Temporal Dimensions

		Relig. Index	Value TF I	Pers. TF I	Self- Cont.	T. Disc	T. Dist	T. Depth Short	T. Depth Mid	T. Depth Long
Value	Tau B	-0.31 ***								
TF I	Ν	800								
Pers.	Tau B	0.05	0.04							
TF I	Ν	800	806							
Self-	Tau B	-0.04	-0.04	-0.03						
Cont.	Ν	800	806	812						
T. Disc	Tau B	-0.11 ***	0.06	-0.03	0.04					
1. Disc	Ν	800	806	812	829					
T. Dist	Tau B	-0.03	0.03	-0.06 *	0	0				
	Ν	800	806	812	831	825				
T. Denth	Tau B	0.03	-0.01	0.07 *	0	- 0.01	-0.09 ***			
Short	Ν	705	711	716	717	717	717			
T. Denth	Tau B	0.07 *	-0.02	0.06	0.02	0	-0.11 ***	0.58 ***		
Mid	Ν	693	699	704	705	705	705	704		
T. Depth	Tau B	0.11 ***	-0.02	0.07 *	0	0.03	-0.12 ***	0.38 ***	0.63 ***	
Long	Ν	672	678	683	684	684	684	681	681	
COVID 19	Tau B	-0.07 ***	0.09 ***	-0.04	-0.06 *	0.09 ***	0.15 ***	0.02	-0.02	-0.08 **
Overall Index	Ν	797	802	808	849	825	828	715	703	682

*Not*e. The multiple correlations from the correlation matrix were corrected by the False Discovery Rate method. Statistically significant results are marked asterisks: ** p < .01, *** p < .001.

General discussion

Throughout this study in progress, we assessed the relationship between religiosity and the two temporal foci and the global magnitude of four temporal dimensions (self-continuity, distance, discounting, and depth), both individually and across culture clusters, and both before and during the COVID-19 pandemic.

First, in the sample collected before the pandemic we observed a pattern of results that can be interpreted in the framework of the uncertainty hypothesis: people from countries with worse and more unstable economies may feel more existential insecurity and therefore be more religious, more tradition-oriented, have longer horizons, and discount more than those from countries with a stronger economy. In addition, at the individual level we found that the greater the religiosity, the more traditionalism, the greater the time discounting, and the greater the temporal depth.

Second, we examined whether or not the pandemic affected the global magnitude of the temporal dimensions. In Chapter IV we showed that the pandemic was associated with a reduction of religiosity and an increase of the progressivism of young people. Although the Uncertainty Hypothesis and the religious coping approach predict that in times of insecurity religiosity tends to increase, we showed that young people of all cultures relied more on the scientific-technological progressive values than on religion, probably because they had an secular approach to cope with this crisis, and they felt that the best way to deal with the pandemic was by trusting science and technology (mainly the creation of a vaccine but also the technological developments that allowed working or communicating with other people online; see Callizo-Romero, 2020, for an opinion article on this matter).

Considering the decrease in religiosity and the increase in progressive values during the pandemic, and based on our previous results, we would expect global time discounting to decrease (i.e, to find a greater proportion of farther choices) and time horizons to decrease because of the arrival of the pandemic. We found this pattern, but only in the progress-oriented cluster of cultures in which people were from countries with a stronger economy. Although the pandemic correlated with a greater focus on progress and a decrease in religiosity in young people over the whole set of studied cultures, this only had repercussions on time discounting and time horizons in those countries with stable and strong economies. The lack of effect on time discounting and time horizons in

CHAPTER VII RELIGIOSITY, TEMPORAL FOCI, AND MAGNITUDES

people living in the tradition-oriented cluster of countries could be because the change during the pandemic was counteracted by the fact that they still lived in countries with unstable economies, even more so during the pandemic.

These findings could have practical consequences since the socio-economic situation of a country and its related discounting rate is correlated with several important variables (Wang et al., 2016). For example, a higher discounting rate correlates with lower innovation capability (see also Hardisty & Weber, 2009), or lower credit rating (e.g., credit card borrowing and debt maturity choice, see also Breuer et al., 2014). Furthermore, it has also been related to behavioral finance or capital movement between countries (Buiter, 1981).

The results also showed an association of the pandemic with a longer global time distance (both when comparing samples collected before and during the pandemic and when correlating the COVID-19 impact index with time distance during the pandemic). We do not consider this to be related to the observed change in temporal values and religiosity since they do not correlate with each other. The expansion in time distance during the pandemic could be due to the experience of confinement, consistently with the findings of other studies: Chaumon et al. (2022) showed that the more isolated the participants felt, the more temporal distance they felt (see also Cravo et al., 2022), and Rioux et al. (2022) reported that confinement slowed the passage of time.

Finally, we observed that during the pandemic the correlations of religiosity with the rest of the variables maintained the same pattern as that shown before the pandemic: greater religiosity correlated with greater past value temporal focus, greater (although not significantly) future personal temporal focus, greater time discounting, and longer time horizons. In addition, the negative relationship between temporal distance and temporal depth found in the sample collected before the pandemic was maintained in the sample collected during the pandemic. All this indicated that although the pandemic could change the overall magnitude of some temporal variables (i.e., the intercepts in global time discounting and temporal depth, as shown above), the relationship between these variables maintained the same structure both before and during the pandemic.



CHAPTER VIII: STUDY 6

TIME CONCEPTUALIZATION ACROSS RELIGIONS¹¹

¹¹ The content of this chapter is an empirical study in preparation. Here I show the results of the preliminary analyses. This content can be referenced as :

Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022d). *Time conceptualization across religions*. [Manuscript in preparation]. Department of Experimental psychology, University of Granada.

Highlights (in relation to research goals):

- There were no differences between Christians and Muslims from the overall samples when comparing them in temporal asymmetry or global magnitude in time distance, self-continuity, time discounting, or depth (in relation to research goals #5.1).

- There were no differences between Catholics, Orthodox Christians, and Muslims when comparing the three groups from Bosnia-Herzegovina in temporal asymmetry or global magnitude in time distance, selfcontinuity, time discounting or depth, except for an effect on global selfcontinuity in the sample collected before the pandemic (in relation to research goals #5.2). Does religion itself affect the human conceptualization of time? Religion is a fundamental factor in culture (Purzycki et al., 2016) that helps to interpret and guide behavior, provides answers to metaphysical questions, and creates solidarity groups (Cohen, 2011; Cohen et al., 2003; Gracia et al., 2017; Saroglou & Cohen, 2011). In addition, religion affects diverse cognitive processes (e.g., Colzato et al., 2008; Colzato et al., 2010; see Hommel & Colzato, 2010, for a review). The WEIRD bias also exists in studies in the field of psychology of religion, where religion has been assimilated particularly with the Judeo-Christian understanding of the concept (Newson et al., 2021). It is therefore important to compare religions to examine how people think about time (Gallois, 2007).

Among the studies in the previous literature that did compare across religions, there have been some indications of religion-specific effects on the representation and processing of time. Li and Cao (2021b) showed that Taoists tend to adopt the time-moving perspective, whereas atheists tend to adopt the ego-moving perspective because the latter had a higher level of personal agency. Some prior studies have also assessed the effect of religion on some of the temporal dimensions that have been measured in this dissertation. In time spatialization, Li and Cao (2018c) found a future-in-front mapping in Taoists and a past-in-front mapping in Buddhists, which they expected because Buddhists might be oriented to the past by the idea of karma and Taoists to the future by the idea of immortality (although this is just a possibility as the authors did not measure temporal focus). Regarding global self-continuity, Tibetan monks have been shown to have less self-continuity than Indians or Americans, as the former reject the idea of a unitary, temporally persistent self (Nichols et al., 2018; see also Sedikides et al., 2022; Siderits, 2007). Finally, in time discounting Paglieri et al. (2013) showed a higher discounting rate for Italian Catholics (who believed in the concept of a sin-confession-expiation cycle) than for Dutch Calvinists (who believed in the theory of predestination).

The participants collected in the studies shown in this doctoral dissertation, in addition to being from different cultures, declared themselves to be of different religions or religious attitudes (see the percentages of religious affiliations and attitudes in the samples collected before and during the pandemic in Chapter IV). Although the analyses are still in a preliminary stage, we report here the effect of religion itself on all the temporal variables addressed in this dissertation: proportion of future in front, selfcontinuity asymmetry index, global self-continuity, time distance asymmetry index, global time distance, time discounting asymmetry index, global time discounting,

CHAPTER VIII TIME CONCEPTUALIZATION ACROSS RELIGIONS

temporal depth asymmetry index, and global temporal depth (in the short-, mid-, and long-term). We first compared all the participants who self-considered Christian (Catholic, Protestant, and Christian Orthodox) versus all those who self-considered Muslim, which are from countries with different historical backgrounds, languages, institutions, and levels of economic development (see sample description in Chapter IV).

The variability in these factors make difficult disentangling the specific role of religion in temporal conceptualization. For this reason, we also compared all the temporal dimensions in the three main ethnic groups in Bosnia-Herzegovina: Serbs (who are mainly Orthodox Christians), Croats (mainly Catholic Christians), and Bosniaks (mainly Muslim). Religion plays a fundamental role in the building of these ethnic and social identities, especially since the Bosnian War (Dušanić, 2007; Hacic-Vlahović, 2008; Sells, 2003). Despite the differences in religion and identity, the three cultures are otherwise highly comparable: all three co-exist in the same country, share historical backgrounds and institutions, and have a similar socioeconomic level and degree of access to education and jobs. All three are mentioned in the Constitution as "constituent nations", meaning that none of them can be considered minorities or immigrants. Regarding language, although there are three different official languages (Serbian, Croatian, and Bosnian) in Bosnia-Herzegovina, all of them are fully mutually intelligible and do not differ in their spatio-temporal semantics or grammatical time reference (Brown, 2004).

Comparing Christians and Muslims across cultures

We compared self-declared Christians (Catholic, Protestant, and Orthodox) with Muslims from the entire sample collected both before and during the pandemic in all temporal dimensions. The sample size of each group is shown in Table VIII.1.

	PRE-COVI	ID19	DURING COVID19		
Religion	Christian	Muslim	Christian	Muslim	
Self-Cont.	290	215	281	79	
Self-C Index	290	215	281	79	
T. Disc. Global	285	197	276	75	
T. Disc. Index	285	197	276	75	
T. Dist Global	289	216	277	79	
T. Dist. Index	289	216	277	79	
T. Depth Short Global	365	183	240	63	
T. Depth Mid. Global	365	183	240	63	
T. Depth Long Global	365	183	240	63	
T. Depth Short Index	365	183	240	63	
T. Depth Mid Index	365	183	240	63	
T. Depth Long Index	365	183	240	63	
T. Depth Global SD	365	183	240	63	
T. Depth SD Index	365	183	240	63	
Personal TF Index	290	216	273	72	
Value TF Index	450	225	272	70	

Table VIII.1

Sample Sizes of Each Group

We first compared the religiosity level of the groups and observed that Muslims were more religious than Christians both before the pandemic, t = 3.31, p = .006, and during the pandemic, t = 5.06, p < .001, so we used religiosity as a covariate for the rest of the comparisons. Then we ran a series of linear models examining the effect of the Religion variable (being self-considered Christian or Muslim) on each temporal dimension. After the FDR correction we found no statistically significant result: when

controlling for religiosity, religion itself did not affect any of the addressed temporal dimensions.

Comparing Bosniaks, Croats, and Serbs from Bosnia-Herzegovina

In the following analyses, we compared Croats (Catholics), Serbs (Orthodox Christians), and Bosniaks (Muslims) who declared themselves believers (i.e., excluding non-believers and agnostics). See the sample size of each group in each temporal dimension in table VI.8).

Table VIII.2

	PRECOV	TD19		COVID19		
Cultural group	Bosniaks	Croats	Serbs	Bosniaks	Croats	Serbs
Self-Cont.	76	82	69	17	65	64
Self-C Index	76	82	69	17	65	64
T. Disc. Global	74	79	66	16	64	61
T. Disc. Index	74	79	66	16	64	61
T. Dist Global	77	82	68	17	63	63
T. Dist. Index	77	82	68	17	63	63
T. Depth Short Global	62	74	126	15	56	53
T. Depth Mid. Global	62	74	126	15	56	53
T. Depth Long Global	62	74	126	15	56	53
T. Depth Short Index	62	74	126	15	56	53
T. Depth Mid Index	62	74	126	15	56	53
T. Depth Long Index	62	74	126	15	56	53
T. Depth Global SD	62	74	126	15	56	53
T. Depth SD Index	62	74	126	15	56	53
Personal TF Index	77	82	69	16	62	61

Sample Sizes of Each Group
Value TF Index	77	82	145	15	62	60
----------------	----	----	-----	----	----	----

As there was variability in the degree of religiosity of the Bosnia-Herzegovina cultural groups both in the sample collected before, F(2) = 8.13, p <.001, and during the pandemic, F(2) = 15.54, p <.001, we controlled the planned comparisons by religiosity. After correcting all comparisons by the FDR, we found no statistically significant effect of religion itself in the temporal dimensions addressed, except in global self-continuity in the sample collected before the pandemic, F(2) = 8.79, p <.001. A post hoc analysis showed that Croats (Catholics) had higher continuity than both Serbs (Orthodox Christians), t = 3.89, p <.001, and Bosniaks (Muslims), t = 3.31, p <.01. We found no other effect of religion itself on the studied temporal variables.

General discussion

We found no effect of religion itself on any asymmetry index or the global magnitude of the temporal dimensions in any sample with a single exception: in the sample collected in Bosnia-Herzegovina before the pandemic, Croats (Catholics) had greater temporal selfcontinuity than Serbs (Orthodox) and Bosniaks (Muslims). This does not seem to be explained by Catholics having a greater belief in the permanence of the self than Orthodox Christians and Muslims since to the best of our knowledge this idea is not peculiar to Catholicism (however it is against of Buddhism doctrine, which could explain the overall low self-continuity of Tibetan Buddhist monks; see Nichols et al. 2018). Moreover, this effect was only significant in one Bosnian group before the pandemic, but it was not significant during the pandemic, nor in the comparison of all Christians with all Muslims neither before nor during the pandemic), so it could be a false positive. Future studies may shed more light on this issue.

All in all, it seems that while the degree of religiosity is a relevant factor for time conceptualization (as repeatedly shown in this dissertation), religion itself does not seem to play any role on that matter, at least when comparing Christians and Muslims and in the set of measures selected here. Further studies could compare more religions on the temporal dimensions here addressed as well as in others to shed light on this issue.



CHAPTER IX: GENERAL DISCUSSION

Summary of findings

Through six empirical studies (shown in the Chapters III, IV, V, VI, VII, and VIII, respectively), we address all of our objectives. We examined how people from different cultures (American, Spanish, Serbian, Bosnian, Bosnian, Croatian, Moroccan, Turkish, and Chinese) and religions or religious attitudes (mainly Christian, Muslim, and non-believers) think about time. In particular, we studied the role of temporal focus (both value and personal) and religiosity on five temporal dimensions: spatialization, perceived distance, self-continuity, discounting, and temporal depth regarding both temporal asymmetry and temporal magnitude.

Most of our studies (Chapters III-VI) were devoted to examining the perceived *asymmetry* between the past and the future in the temporal dimensions indicated, from the framework of the Conceptual Metaphor Theory. We showed that unlike predicted from the conceptual metaphor TIME IS SPACE, value temporal focus affected both time spatialization and temporal asymmetry in time discounting.

In addition, we showed preliminary results of studies in progress in which we examined the role of temporal foci and religiosity on the perceived global *magnitude* in the temporal dimensions addressed. For this we relied on the Uncertainty Hypothesis and found, according to our predictions, that people from cultures with greater economic instability were more religious, more traditional, thought more about their own future, discounted more and had longer time horizons.

Finally in a last study (Chapter VIII) we showed that while culture and religiosity were relevant factors for time conceptualization in the temporal dimensions addressed (both with respect to temporal asymmetry and global magnitude), religion itself did not (at least in the comparison between Muslims and Christians). A summary of the findings for each research objective is shown below.

1. To explore how people's <u>temporal foci and religiosity</u> vary across cultures (American, Spanish, Serbian, Bosnian, Bosnian, Croatian, Moroccan, Turkish, and Chinese) and due to the Covid-19 social crisis. For this purpose, I proposed the following five sub-goals:

1.1. To explore value temporal focus (i.e., the attention given to past values, such as tradition, versus the future, such us progress) across cultures (Chapter III and V).

Regarding value temporal focus, we found that Spaniards, Chinese, and Turks were oriented to values related to the future (e.g., progress; and they were also less religious than the group average), while Moroccans, Bosniaks, Croats, and Serbs were oriented to values related to the past (e.g., tradition; and they were also more religious than the group average). Americans showed a balance between progressivism and traditionalism.

1.2. To explore whether or not and how value temporal focus and religiosity varied due to the arrival of the pandemic (Chapter IV).

During the pandemic, young people across cultures were less religious and more progress-oriented than matched people of the same age range before the pandemic. The relationship between these two variables was strong both before and during the pandemic. In addition, during the pandemic, the greater the psychological impact of the pandemic situation, the less religiosity and the greater the future (progressive) orientation.

1.3. To explore personal temporal focus (i.e., the attention given to their personal past versus future) across cultures (Chapter V).

Regarding personal temporal focus, Croats, Serbs, Bosniaks, Americans, and Moroccans were oriented to their personal future, while Turks, Spaniards, and Chinese were balanced in the attention paid to their personal past and future.

1.4. To explore whether or not and how personal temporal focus varied due to the arrival of the pandemic (Chapter VI).

We did not find a change in personal temporal focus due to the arrival of the pandemic.

1.5. To explore the relationship between value temporal focus, personal temporal focus and religiosity across individuals and cultures and before and during the pandemic (Chapter VI).

We found that value and personal temporal focus can be dissociated. The correlation between value and personal temporal foci at the individual level was negative but not statistically significant. At the group level, the groups were divided into clusters in which the two temporal foci showed opposite patterns.

This dissociation between temporal foci could be explained within the framework of the Uncertainty Hypothesis: people who were more religious and with greater economic instability and insecurity were more traditional but more oriented to their personal future probably because they were more concerned about their personal future.

2. To study the relation between value temporal focus and time <u>spatialization</u> by testing the Temporal Focus Hypothesis (TFH). For this purpose, I proposed two sub-goals:

2.1. To test how general the TFH is across cultures (Chapters III and VI). Our results in Chapter III offered support for the Temporal Focus Hypothesis (TFH): whether the past or the future is conceptualized as in front varies depending on value temporal focus. First, we created a predictive model using data about temporal focus and the proportion of future in front responses from 10 Western cultural (sub)groups. We then applied the model successfully to 12 independently collected cultural (sub)groups in China, Vietnam, UK, and South Africa. Finally, a model created to fit the whole dataset showed a small but significant effect of value temporal focus on time spatialization.

In Chapter VI we showed that unlike the value temporal focus, the personal temporal focus was not related to temporal spatialization across cultures.

2.2. To test whether or not temporal spatialization changed according to variations in value temporal focus and religiosity due to the pandemic (Chapters IV and VI).

The samples collected during the pandemic were more oriented to the future values and placed the future in front in a higher proportion than the samples collected before the pandemic. Moreover, in the samples collected during the pandemic, we found that the greater the psychological impact of the pandemic situation, the greater the tendency to place the future in front.

3. To study the relationship of temporal focus on the past or future <u>asymmetry</u> in the temporal distance, self-continuity, time discounting, and temporal depth. For this purpose, I proposed five sub-goals:

3.1. To explore if there is future asymmetry, past asymmetry, or symmetry in the dimensions of temporal distance, self-continuity, temporal discounting, and temporal depth across cultures (Chapter V).

There was symmetry in temporal distance and future asymmetries in selfcontinuity, time discounting, and temporal depth. The effect sizes of the asymmetries were generally small and their size was larger in the tasks that required entertaining longer temporal intervals.

3.2. To explore whether or not putative temporal asymmetries were predicted by either value temporal focus or personal temporal focus or both (Chapter V).

There was only a systematic effect of value temporal focus on time discounting in the expected direction: future-focus was positively associated with choosing a larger but farther reward in the future than in the past. This was shown both at the individual level and when comparing the progress-oriented with the traditionoriented cultures. Neither value nor personal temporal focus showed systematic effects on the other temporal asymmetries.

3.3. To explore whether or not the past and the future maintained a negative or positive relationship in our mind (Chapter V).

Past and future held a positive (instead of negative) relation in the mind in all the dimensions studied: time distance (the greater the perceived distance into the future, the greater the perceived distance into the past), self-continuity (the greater the future-continuity, the greater the past-continuity), time discounting (the smaller the discount rate for future rewards, the smaller the discount rate for past rewards) and temporal depth (the greater the depth in the future, the greater the depth).

3.4. To explore whether or not the asymmetries of the different temporal dimensions were related to each other (Chapter V).

The asymmetries of the different dimensions were not correlated among them, which indicates that they are not part of the same larger construct, but that temporal thought has a complex underlying structure. This also implies that the asymmetries in some measures cannot be explained by the existence of asymmetries in other measures. **3.5.** To explore the potential change in temporal asymmetries and their relationship with the temporal focus due to the COVID-19 social crisis (Chapter VI).

As expected, the increase in value temporal focus during the pandemic was only related to the temporal asymmetry in time discounting. We found no other changes in temporal asymmetries due to the arrival of the pandemic.

4. To study the relationship of temporal foci and religiosity with the global <u>magnitude</u> of time distance, self-continuity, time discounting, and temporal depth across cultures. For this purpose, I proposed two sub-goals:

4.1. To study the relationship of temporal foci and religiosity with the global magnitude of time distance, self-continuity, time discounting, and temporal depth across cultures before the arrival of COVID-19 social crisis (Chapter VII). Religiosity was negatively related to value temporal focus and positively related to personal temporal focus, time discounting, and time horizons across cultures and individuals.

4.2. To study whether or not the potential changes in temporal foci and religiosity due to the COVID-19 social crisis had an effect on the global magnitude of time distance, self-continuity, time discounting, and temporal depth across cultures (Chapter VII).

Changes in religiosity and value temporal focus during the pandemic were accompanied by changes in time discounting and temporal depth.

5. To explore the role of <u>religion itself</u> (comparing Christians and Muslims) on time conceptualization (Chapter VIII).

5.1. To study whether Christians and Muslims from the overall samples varied in their temporal conceptualization in the dimensions of temporal asymmetry and global magnitude in distance, self-continuity, time discounting, and temporal depth.

There were no differences between Christians and Muslims from the overall samples when comparing them in any dimension of temporal asymmetry or global magnitude. **5.2.** To study if believers from the three main groups in Bosnia-Herzegovina: Serbs (mainly Orthodox Christians), Croats (mainly Catholic Christians), and Bosniaks (mainly Muslim) varied in their temporal conceptualization in the dimensions of temporal asymmetry and global magnitude in distance, selfcontinuity, time discounting, and temporal depth.

There were no differences between Catholics, Orthodox Christians, and Muslims when comparing the three groups from Bosnia-Herzegovina in any dimension of temporal asymmetry or global magnitude except for an effect on global selfcontinuity in the sample collected before the pandemic.

The findings in context

In the previous section, I summarized findings related to the main goals of the dissertation, which concern the relationship of temporal foci and religiosity to 1) perceived asymmetry between past and future in spatialization, temporal distance, self-continuity, time discounting, and temporal depth; and the 2) perceived global magnitude in time distance, self-continuity, time discounting, and temporal depth. We studied these issues across cultures and religions with samples collected both before and during the advent of the Covid-19 social crisis. In this section, I interpreted these findings in the context of the broader literature and their theoretical framework.

Perceived asymmetry between the past and the future

Time spatialization

Present results provide consistent evidence supporting the main tenet of the TFH: when measured in terms of temporal values, variations in temporal focus predict the proportion of future-in-front responses, both when temporal focus varies across a number of cultures and across an important social crisis, the COVID-19 pandemic. The effect was small but significant.

Unlike value temporal focus, personal temporal focus was not associated with time spatialization which contrasts with some evidence showed with Chinese participants (Li, 2021; Li & Cao, 2018a; 2018b; 2019; 2021b). This may be due to the fact that the personal temporal focus is a better predictor of spatialization when studying individual differences

CHAPTER IX GENERAL DISCUSSION

in cultures that are not base-biased in their personal temporal focus (such as China as shown in Chapter V). We encourage future studies to test this possibility.

Since the content of Chapter III was published, there have been two new studies testing the effect of value temporal focus on time spatialization: Starr and Srinivasan (2021) supported the Temporal Focus Hypothesis (TFH) by showing that temporal focus predicted the proportion of future-in front in Indian children. In contrast, Qin (2021) found no evidence in favor of temporal focus predicting the proportion of future-in-front in two experiments with Chinese participants. The author argued that this lack of effect could be due to two limitations of the study: the low reliability of the scale used for measuring value temporal focus (a Chinese version of the Temporal Focus Questionnaire; α =.62) and the existence of a confounding variable. The raw data from the Qin (2021)'s study are not publicly available, so we were not able to add that data to the predictive model described in Chapter III. However, this study along with Bylund et al. (2020)'s study are the only two works that have shown evidence against the TFH using value temporal focus to predict time spatialization. On the contrary, all the remaining published studies support it (i.e., the studies shown in Chapter 3 including the samples from the eight cultures we collected before the pandemic, the studies from de la Fuente et al, 2014; Gu et al., 2019; Li et al., 2018; Li &Cao, 2017; as well as the findings in Chapter IV with the eight samples collected during the pandemic, and the Starr & Srinivasan (2021)'s study). The observed proportion of non-significant results in the available studies is below what might be expected by chance if the effect is real, although publication bias makes impossible to know what is the actual total number of studies that may have failed to find the effect.

All in all, most evidence supports the existence of an association between value temporal focus and the tendency to spatialize future in front and past behind. Given that this evidence does not follow from the implications of the conceptual metaphor TIME IS SPACE, the findings suggest that the metaphor ATTENDING IS SEEING underlies people's temporal spatialization, or at least coexists with the TIME IS SPACE conceptual metaphor, modulating its effect.

Temporal asymmetry in time distance, self-continuity, time discounting, and time horizons

Contrary to the clear pattern observed regarding time spatialization, the findings regarding temporal asymmetries are more difficult to interpret. In most of the assessed

temporal dimensions (self-continuity, time discounting, and temporal depth) there were future asymmetries that were not affected or affected to a small degree by temporal focus, without full reversals in any case. There was a limited effect of the value temporal focus on the time discounting measure, which was convergent with the results found during the pandemic: traditional cultures increased their values on progress and also increased their future asymmetry. This may suggest a broad influence of the TIME IS SPACE conceptual metaphor combined with a small and circumscribed influence of the ATTENDING IS SEEING metaphor. However, we also obtained evidence that directly contradicts an influence of the TIME IS SPACE metaphor: there was not any asymmetry in temporal distance (i.e., we failed to replicate the Temporal Doppler Effect) and there was a positive, instead of a negative, relationship between past and future in all measures.

The pattern of results is also difficult to understand from the ATTENDING IS SEEING metaphor: the asymmetries found do not seem to arise from the possible effect of value temporal focus on the construal level at which we process information related to past and future events, as this would predict an asymmetry in time distance, which would then explain the other asymmetries. Moreover, both accounts would predict that the measured temporal dimensions should have correlated to some extent with each other, but we did not find those correlations.

One interesting possibility is that temporal focus only affects the emotional evaluation of the past and the future, but not the perceived distance regarding the past and future events. This might explain why temporal focus only affected time discounting, where event evaluation is explicitly assessed, and is consistent with paying more attention to the focused events and thereby placing them in front. Moreover, it does not predict negative correlations between past and future responses, but predicts null correlations instead. A broad influence of TIME IS SPACE could explain the overall future asymmetry observed, and its absence in temporal distance might be due to the short interval (one month) that participants had to consider in this task. Perhaps longer intervals (one or more years) might show the asymmetry. Previous research showed that at shorter time intervals, the size of the TDE is smaller than at longer intervals, even disappearing (Gan et al., 2017; Peetz et al., 2009). However, this account, again, fails to explain the positive correlations between future and past responses in all measures as well as the lack of correlation between measures, not to mention that it is unsatisfactorily cumbersome. A final understanding of this pattern of results must await future research.

The perceived magnitude in time distance, self-continuity, time discounting, and time horizons

We suggested that the insecurity produced by economic instability may modulate religiosity (according to the Uncertainty Hypothesis; see Barber, 2011) and this could explain the dissociation of temporal foci as well as the overall discount rate and time horizons of people across cultures.

This possibility sheds light on issues that were unclear in the previous literature. One of these is the relationship between religiosity and time discounting (see Marcus & McCullough, 2021). We considered that while religiosity might be related to lower discount rates because religions encourage delayed gratification (Carter et al., 2012) this relationship might modulate and even reverse when people's economic situation is unstable (either due to being in a country with an unstable economy or due to their personal economy). Our results also shed light on the opposite relationship shown between temporal discounting and temporal depth: although we might expect that longer time horizons lead to choosing delayed rewards, in contexts of economic insecurity people might have longer-term horizons (because looking at the longer term provides a sense of meaning and stability, and because they are more religious which could lead to longer temporal horizons, see Łowicki et al., 2018), but discount more because they need the money sooner. Future studies measuring the socioeconomic level of people together with the variables addressed here will be able to test our predictions.

Reinterpreting the Janus figure in light of the dissertation findings

What does the figure of Janus reveal about the conceptualization of time now that we can interpret it in the light of our findings? Janus could be future-oriented due to his bodily experience of moving forward. In fact, the Romans associated this god with movement and conceived him as a symbol of progress from the past to the future (Roman & Roman, 2010). However, they also attributed to him traditional values and a focus on the past, what suggests that he probably placed the past in front. It could be that, according to the Romans' beliefs, Janus had a past value temporal focus but a future personal temporal

focus (see Chapters V and VI). It could also be that his value temporal focus varied over periods of prosperity versus social crisis (while also changing his tendency to place the past in front; Chapter IV). Moreover, we can speculate that the temporal foci that the Romans attributed to Janus had repercussions on how they thought he would economically evaluate past and future events and on his time horizons.

Regarding the economic evaluation of past and future events, it is worth noting that the Romans associated Janus not only with time, but also with money, trade, and economic prosperity. In fact, his two-faced head appeared on a large part of the coins of the Roman Republic (Blasco, 2013). How would be Janus' time discounting attitude? Overall, he would prefer future to past deals (Chapter V), although this preference would be less strong when social order was under threat. Being part of a traditional culture, perhaps the Romans also thought that in times of social crisis, where Janus would increase his traditional values, he would also discount more, so that he would obtain money quickly that perhaps he could offer to the Romans to assist with the crisis. In periods of social prosperity, where traditional values would be less important, he would discount less because the money would not be needed quickly and this would allow Romans to have a richer future.

Regarding time horizons, when the Romans went through periods of crisis increased their devotion and resorted to the figure of the god Janus to have an immortal image of Rome that could offer them psychological security and stability (Blasco, 2013). Thus, they considered that Janus had very long-term horizons and that he could reach with his gaze the remote past (the foundational origin) and the very long-term future (Blasco, 2013). These horizons probably became even deeper in moments of crisis. Interestingly, it should be noted that the Romans thought that Janus was the bridge and the dor that connect past and future and that the wider his horizon was towards the past, the wider it would also be towards the future (Holland, 1961) so that both temporal moments could maintain a positive relationship in his head (a pattern that makes intuitive sense but for which we do not have as yet an adequate explanation, see Chapter V and the discussion above).

At the beginning of the Introduction of this doctoral dissertation, I quoted from the *Fasti* in which Ovid asked Janus why he had two heads. A little further on, Ovid asked him why he is the god associated with time and the calendar. By referring to the figure of Janus in this dissertation, I have not tried to find out how Janus actually thought about time — I think this will always be a mystery. Instead, I have tried to use his figure as a

source of inspiration about how we humans think about time. Based on the data collected all over the world we discovered that the human mind tends to focus on the past or the future to varying degrees depending on cultural values and social circumstances (such as a social crisis or an unstable economic environment), and that this, in turn, can affect how we associate space with time, the asymmetry in time discounting, and our global time discounting and horizons. In short, in the course of this work, the figure of the god Janus, although still mysterious, has helped us to shed some light on the human conceptualization of time.

Concluding remarks

The main goal of this doctoral dissertation was to study the role of temporal focus role on the temporal asymmetry to examine the conceptual metaphors by which we think; also their role on perceived temporal global magnitudes. We found that value temporal focus (the attention paid to values related to tradition versus progress) and religiosity vary across individuals, cultures, social crises (such as the COVID-19 pandemic) and depending on socioeconomic context.

Regarding the study of temporal asymmetry, our results showed that the value temporal focus predicts time spatialization on the sagittal axis. It also affects the asymmetry in the economic evaluation given to past versus future events. All this provided evidence against the predictions of the TIME IS SPACE conceptual metaphor and suggested that other metaphors, specifically the ATTENDING IS SEEING metaphor, are actively shaping temporal thought. However, in self-continuity and time horizons, we found overall future asymmetries unaffected by temporal focus. Together with clear positive correlations between responses toward the past and the future in all tasks and null correlations across tasks, the pattern of results regarding temporal asymmetry fails to completely match the expectations from both conceptual metaphors and claims for further theoretical development.

Furthermore, in the work in progress reported in Chapter VI, we found that greater religiosity is associated with past value temporal focus and future personal temporal focus across cultures, and speculated that this can be explained by the insecurity that people living in unfavorable and unstable economies may feel: it makes intuitive sense that economic uncertainty may make people more traditional, religious (as tradition and religion offer comfort and guidance in dealing with the situation), oriented to their personal future (because they are more concerned about their tomorrow), discount more (because of reduced trust in future conditions) and have longer horizons (because nothing seem to change in the short term and looking at the longer term provides a sense of meaning and stability) than people living in countries with a stronger economy, who are less religious and more oriented to progressive values. We confirmed these speculations on the perceived temporal magnitude in time discounting and temporal depth across cultures in the study in progress shown in Chapter VII. Moreover, also in this line, we showed that changes in religiosity and value temporal focus during the pandemic were associated with changes in global time discounting and temporal depth, in the expected direction.

Finally, in Chapter VIII we found that while religiosity is a relevant factor in temporal conceptualization, religion itself (at least when comparing Christians and Muslims) does not appear to be one. I encourage future studies to examine the role of other religions (such as Buddhism, Hinduism, Judaism or Taoism) on temporal dimensions.

Temporal thought is a complex subject that has captured the interest of many thinkers throughout history. Through the present work we have tried to shed light on this old problem by overcoming the WEIRD bias that unfortunately still characterizes most studies in psychology. However, this has just been one more piece toward completing the still mysterious puzzle of time conceptualization. It is my hope that both the findings and the new questions raised in the present doctoral dissertation are revealing and encourage further study of how people from different cultures and religions think about time.



REFERENCES

REFERENCES

REFERENCES

- Ahmadi, F. (2006). *Culture, religion and spirituality in coping: The example of cancer patients in Sweden.* Acta Universitatis Upsaliensis.
- Ahmadi, N., & Ahmadi, F. (2015). The use of religious coping methods in a secular society: A survey study among cancer patients in Sweden. *Illness, Crisis & Loss*, 25(3), 171–199. <u>https://doi.org/10.1177/1054137315614513</u>
- Aksentijevic, A., & Treider, J. M. G. (2016). It's all in the past: Deconstructing the Temporal Doppler Effect. *Cognition*, 155, 135–145. <u>https://doi.org/10.1016/j.cognition.2016.07.001</u>
- Altınordu, A. (2021). Divine warning or prelude to secularization? Religion, politics, and the COVID-19 Pandemic in Turkey. *Sociology of Religion*, 82(4), 447–470. <u>https://doi.org/10.1093/SOCREL/SRAB033</u>
- Alverson, H. (1994). Semantics and experience: Universal metaphors of time in English, Mandarin, Hindi, and Sesotho. Johns Hopkins University Press.
- Ano, G. G., & Vasconcelles, E. B. (2005). Religious coping and psychological adjustment to stress: A meta-analysis. *Journal of clinical psychology*, 61(4), 461-480. https://doi.org/10.1002/jclp.20049
- Aytaç, I. A., & Rankin, B. H. (2004). Modernity, traditionality, and junior high school attainment in Turkey. *Social Indicators Research*, 66(3), 267–282. <u>https://doi.org/10.1023/B:SOCI.0000003586.32380.21</u>
- Baldacchino, D., & Draper, P. (2001). Spiritual coping strategies: a review of the nursing research literature. *Journal of Advanced Nursing*, 34(6), 833–841. <u>https://doi.org/10.1046/J.1365-2648.2001.01814.X</u>
- Barber, N. (2011). A cross-national test of the uncertainty hypothesis of religious belief.Cross-CulturalResearch,45(3),318-333.https://doi.org/10.1177/1069397111402465
- Bardon, A. (2013). A brief history of the philosophy of time. Oxford University Press.
- Barsalou, L. W. (2008). Grounded cognition. Annual Review of Psychology, 59, 617–645. https://doi.org/10.1146/annurev.psych.59.103006.093639
- Barsalou, L. W. (2010). Grounded cognition: Past, present, and future. *Topics in Cognitive Science*, *2*(4), 716–724. https://doi.org/10.1111/j.1756-8765.2010.01115.x

- Bartoń, K. (2019). MuMIn: Multi-Model Inference (R Package Version 1.43.15) [Computer software]. Retrieved from https://CRAN.Rproject.org/package=MuMIn
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1–48. <u>https://doi.org/10.18637/jss.v067.i01</u>
- Becker, M., Vignoles, V. L., Owe, E., Easterbrook, M. J., Brown, R., Smith, P. B., ... & Lay, S. (2018). Being oneself through time: Bases of self-continuity across 55 cultures. Self and Identity, 17(3), 276-293. https://doi.org/10.1080/15298868.2017.1330222
- Bender, A., & Beller, S. (2011). The cultural constitution of cognition: taking the anthropological perspective. *Frontiers in psychology*, 2, 67. <u>https://doi.org/10.3389/fpsyg.2011.00067</u>
- Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society*. *Series B (Methodological)*, 57(1), 289-300. <u>https://doi.org/10.1111/j.2517-6161.1995.tb02031.x</u>
- Bentzen, J. S. (2021). In crisis, we pray: Religiosity and the COVID-19 pandemic. Journal of Economic Behavior & Organization, 192, 541-583. <u>https://doi.org/10.1016/j.jebo.2021.10.014</u>
- Bergen, B. K., & Chan Lau, T. T. (2012). Writing direction affects how people map space onto time. *Frontiers in Psychology*, 3(109), 1–5. <u>https://doi.org/10.3389/fpsyg.2012.00109</u>
- Bickel, W. K., Yi, R., Kowal, B. P., & Gatchalian, K. M. (2008). Cigarette smokers discount past and future rewards symmetrically and more than controls: Is discounting a measure of impulsivity? *Drug and Alcohol Dependence*, 96(3), 256– 262. <u>https://doi.org/10.1016/j.drugalcdep.2008.03.009</u>
- Bixter, M. T., McMichael, S. L., Bunker, C. J., Adelman, R. M., Okun, M. A., Grimm, K. J., Graudejus, O., & Kwan, V. S. Y. (2020). A test of a triadic conceptualization of future self-identification. *PLOS ONE*, 15(11), e0242504. <u>https://doi.org/10.1371/journal.pone.0242504</u>
- Blasco, M. T. P. (2013). La imagen numismática de Jano. Espacio Tiempo y Forma. Serie II, Historia Antigua, (26), 223-242. <u>https://doi.org/10.5944/etfii.26.2013.13744</u> 274

- Bluedorn, A. C. (2002). *The human organization of time: Temporal realities and experience*. Stanford Business Books.
- Bluedorn, A. C., & Martin, G. (2008). The time frames of entrepreneurs. *Journal of Business Venturing*, 23(1), 1-20. https://doi.org/10.1016/j.jbusvent.2006.05.005
- Bluedorn, A. C., & Standifer, R. L. (2006). Time and the temporal imagination. *Academy* of Management Learning & Education, 5(2), 196-206.
- Bolker, B. (2020). *GLMM FAQ*. Retrieved from <u>https://bbolker.github.io/mixedmodels-</u>misc/glmmFAQ.html#should-i-treat-factor-xxx-as-fixed-or-random
- Bonato, M., Zorzi, M., & Umiltà, C. (2012). When time is space: Evidence for a mental time line. *Neuroscience & Biobehavioral Reviews*, 36(10), 2257-2273. <u>https://doi.org/10.1016/j.neubiorev.2012.08.007</u>
- Bond, M. J., & Feather, N. T. (1988). Some correlates of structure and purpose in the use of time. *Journal of personality and social psychology*, 55(2), 321. <u>https://doi.org/10.1037/0022-3514.55.2.321</u>
- Boniwell, I., & Zimbardo, P. G. (2015). Balancing time perspective in pursuit of optimal functioning. Positive psychology in practice, 223-236. <u>https://doi.org/10.1002/9781118996874.ch13</u>
- Boroditsky, L. (2000). Metaphoric structuring: Understanding time through spatial metaphors. *Cognition*, 75(1), 1–28. <u>https://doi.org/10.1016/S0010-0277(99)00073-6</u>
- Boroditsky, L. (2001). Does language shape thought? Mandarin and English speakers' conceptions of time. *Cognitive Psychology*, 43(1), 1–22. <u>https://doi.org/10.1006/cogp.2001.0748</u>
- Boroditsky, L., Fuhrman, O., & McCormick, K. (2011). Do English and Mandarin speakers think about time differently? *Cognition*, 118(1), 123–129. https://doi.org/10.1016/j.cognition.2010.09.010
- Boroditsky, L., & Gaby, A. (2010). Remembrances of times East: Absolute spatial representations of time in an Australian Aboriginal community. *Psychological Science*, 21(11), 1635–1639. <u>https://doi.org/10.1177/0956797610386621</u>
- Boroditsky, L., & Ramscar, M. (2002). The roles of body and mind in abstract thought. *Psychological science*, *13*(2), 185-189. <u>https://doi.org/10.1111/1467-9280.00434</u>

Bottini, R., & Casasanto, D. (2013). Space and time in the child's mind: metaphoric or ATOMic? *Frontiers in psychology*, 4, 803. https://doi.org/10.3389/fpsyg.2013.00803

Bourdieu, P. (1972). Outline of a theory of practice. Cambridge University Press.

- Breuer, W., Rieger, M. O., & Soypak, K. C. (2014). The behavioral foundations of corporate dividend policy a cross-country analysis. *Journal of Banking & Finance*, 42, 247-265. <u>https://doi.org/10.1016/j.jbankfin.2014.02.001</u>
- Brislin, R. W., & Kim, E. S. (2003). Cultural diversity in people's understanding and uses of time. *Applied Psychology*, 52(3), 363-382. <u>https://doi.org/10.1111/1464-0597.00140</u>
- Britannica, T. Editors of Encyclopaedia (2020, March 20). Deus ex machina. Encyclopedia Britannica. Retrieved from <u>https://www.britannica.com/art/deus-ex-machina</u>
- Brown, W. & Alt, T. (2004). A handbook of Bosnian, Serbian, and Croatian. SEELRC.
- Bruce, S. & Voas, D. (2016). Do social crises cause religious revivals? What British church adherence rates show? *Journal of Religion in Europe 9*(1), 26–43. <u>https://doi.org/10.1163/18748929-00901001</u>
- Brzezinski, A., Kecht, V., Van Dijcke, D., & Wright, A. L. (2021). Science skepticism reduced compliance with COVID-19 shelter-in-place policies in the United States. *Nature Human Behaviour*, 5(11), 1519-1527. <u>https://doi.org/10.1038/s41562-021-01227-0</u>
- Buckner, R. L., & Carroll, D. C. (2007). Self-projection and the brain. *Trends in cognitive sciences*, 11(2), 49-57. <u>https://doi.org/10.1016/j.tics.2006.11.004</u>
- Buiter, W. H. (1981). Time preference and international lending and borrowing in an overlapping-generations model. *Journal of political economy*, 89(4), 769-797. <u>https://doi.org/10.1086/261002</u>
- Buni, N. (2012). Asymmetries in evaluation of past and future events: is the Temporal Asymmetry Effect modulated by culture, gender, task, or emotion? Doctoral dissertation, University of Tübingen. Retrieved on August 5, 2020 from https://publikationen.uni-tuebingen.de/xmlui/handle/10900/49766
- Burns, P., McCormack, T., Jaroslawska, A., Fitzpatrick, Á., McGourty, J., & Caruso, E.M. (2019). The development of asymmetries in past and future thinking. *Journal of*

 Experimental
 Psychology:
 General,
 148(2),
 272–288.

 https://doi.org/10.1037/xge0000464

 <t

- Bylund, E., Gygax, P., Samuel, S., & Athanasopoulos, P. (2020). Back to the future? The role of temporal focus for mapping time onto space. *Quarterly Journal of Experimental Psychology*, 73(2), 174–182.
 <u>https://doi.org/10.1177/1747021819867624</u>
- Cai, Z. G., Connell, L., & Holler, J. (2013). Time does not flow without language: Spatial distance affects temporal duration regardless of movement or direction. *Psychonomic Bulletin & Review*, 20, 973-980. <u>https://doi.org/10.3758/s13423-013-0414-3</u>

Callender, C. (Ed.). (2011). The Oxford handbook of philosophy of time. OUP Oxford.

- Callender, C. (2017). What makes time special? Oxford University Press.
- Callizo-Romero, C. (2020). Tiempos de pandemia: mirando al pasado, mirando al futuro, mirándonos entre nosotros. *Religión Digital*. Retrieved from <u>https://www.religiondigital.org/dialogos/secularizacion-religion-COVID-19-</u> <u>tradicion-progreso-fraternidad-CarmenCallizo_7_2288841107.html</u>
- Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022a). *Deus or machina: The COVID-*19 pandemic and young adults' religiosity, value temporal focus, and time spatialization across cultures. [Manuscript under review]. Department of Experimental psychology, University of Granada.
- Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022b). *Personal and value temporal focus, religiosity, and temporal asymmetry.* [Manuscript in preparation]. Department of Experimental psychology, University of Granada.
- Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022c). *Trust in time. The relationship between religiosity, temporal foci, and time magnitudes across cultures.*[Manuscript in preparation]. Department of Experimental psychology, University of Granada.

- Callizo-Romero, C., Casasanto, D., Chahboun, S., Göksun, T., Gu, Y., Kranjec, A., Ouellet, M., Tutnjević, S., & Santiago, J. (2022d). *Time conceptualization across religions*. [Manuscript in preparation]. Department of Experimental psychology, University of Granada.
- Callizo-Romero, C., de la Fuente, J. M., & Santiago, J. Con todo el pasado por delante: atender al pasado puede ponerlo delante de nosotros. Ciencia *Cognitiva*, 13(1), 14-17.
- Callizo-Romero, C., Tutnjević, S., Pandza, M., Ouellet, M., Kranjec, A., Ilić, S., Gu, Y., Göksun, T., Chahboun, S., Casasanto, D., & Santiago, J. (2020). Temporal focus and time spatialization across cultures. *Psychonomic Bulletin and Review*, 1-12. https://doi.org/10.3758/s13423-020-01760-5
- Callizo-Romero, C., Tutnjević, S., Pandza, M., Ouellet, M., Kranjec, A., Ilić, S., Gu, Y., Göksun, T., Chahboun, S., Casasanto, D., & Santiago, J. (2022). Does time extend asymmetrically into the past and the future? A multitask crosscultural study. *Language and Cognition*, 14(2), 275-302. <u>https://doi.org/10.1017/langcog.2022.5</u>
- Carrión, D. A., & Valenzuela, J. (2021). Distant time, distant gesture: speech and gesture correlate to express temporal distance. *Semiotica*, 2021(241), 159-183. <u>https://doi.org/10.1515/sem-2019-0120</u>
- Carrión, D. A., & Valenzuela, J. (2022). Time as space vs. time as quantity in Spanish: a co-speech gesture study. *Language and Cognition*, 14(1), 1-18. https://doi.org/10.1017/langcog.2021.17
- Carter, E. C., McCullough, M. E., Kim-Spoon, J., Corrales, C., & Blake, A. (2012). Religious people discount the future less. *Evolution and Human Behavior*, 33(3), 224-231. <u>https://doi.org/10.1016/j.evolhumbehav.2011.09.006</u>
- Caruso, E. M. (2010). When the future feels worse than the past: A temporal inconsistency in moral judgment. *Journal of Experimental Psychology: General*, 139(4), 610–624. <u>https://doi.org/10.1037/a0020757</u>
- Caruso, E. M., Gilbert, D. T., & Wilson, T. D. (2008). A wrinkle in time: Asymmetric valuation of past and future events. *Psychological Science*, 19, 796-801. <u>https://doi.org/10.1111/j.1467-9280.2008.02159.x</u>

- Caruso, E. M., Van Boven, L., Chin, M., & Ward, A. (2013). The Temporal Doppler Effect. *Psychological Science*, 24(4), 530–536. <u>https://doi.org/10.1177/0956797612458804</u>
- Casasanto, D. (2008). Who's afraid of the big bad Whorf? Crosslinguistic differences in temporal language and thought. *Language learning*, 58, 63-79. <u>https://doi.org/10.1111/j.1467-9922.2008.00462.x</u>
- Casasanto, D. (2009). Embodiment of abstract concepts: Good and bad in right- and lefthanders. Journal of Experimental Psychology: General, 138(3), 351–367. <u>https://doi.org/10.1037/a0015854</u>
- Casasanto, D. (2014). Experiential origins of mental metaphors: Language, culture, and the body. In M. Landau, M. D. Robinson, & B. P. Meier (Eds.), *The power of metaphor: Examining its influence on social life* (pp. 249–268). American Psychological Association. <u>https://doi.org/10.1037/14278-011</u>
- Casasanto, D., & Boroditsky, L. (2008). Time in the mind: Using space to think about time. *Cognition*, *106*(2), 579-593. <u>https://doi.org/10.1016/j.cognition.2007.03.004</u>
- Casasanto, D., & Bottini, R. (2010, August). Can mirror-reading reverse the flow of time? In *International Conference on Spatial Cognition* (pp. 335-345). Springer, Berlin, Heidelberg. <u>https://doi.org/10.1007/978-3-642-14749-4_28</u>
- Casasanto, D., & Bottini, R. (2014). Mirror reading can reverse the flow of time. *Journal* of *Experimental Psychology: General*, 143(2), 473. <u>https://doi.org/10.1037/a0033297</u>
- Casasanto, D., & Jasmin, K. (2012). The hands of time: Temporal gestures in English speakers. *Cognitive Linguistics*, 23(4), 643-674. <u>https://doi.org/10.1515/cog-2012-002</u>
- Chaumon, M., Rioux, P. A., Herbst, S. K., Spiousas, I., Kübel, S. L., Gallego Hiroyasu, E. M., ... & van Wassenhove, V. (2022). The Blursday database as a resource to study subjective temporalities during COVID-19. *Nature Human Behaviour*, 6(11), 1587-1599. https://doi.org/10.1038/s41562-022-01419-2
- Christie, L., & Halpern, J. M. (1990). Temporal constructs and Inuit mental health. Social Science & Medicine, 30(6), 739-749. <u>https://doi.org/10.1016/0277-9536(88)90260-</u> <u>2</u>
- Cienki, A. J. (1998). Metaphoric gestures and some of their relations to verbal metaphoric expressions. *Discourse and cognition: Bridging the gap*, 189-204.

- Clark, H. H. (1973). Space, time, semantics and the child. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language* (pp. 27–63). Academic Press.
- Cloete, E. (1992). Afrikaner identity: Culture, tradition and gender. *Agenda: Empowering Women for Gender Equity*, *13*, 42–56. <u>https://doi.org/10.2307/4065612</u>
- Cohen, A. B., Siegel, J. I., & Rozin, P. (2003). Faith versus practice: Different bases for religiosity judgments by Jews and Protestants. *European Journal of Social Psychology*, 33(2), 287–295. <u>https://doi.org/10.1002/ejsp.148</u>
- Cohen, A. B. (2011). Religion and culture. *General Psychological Issues in Cultural Perspective*, 44(10), 589–592. <u>http://doi.org/10.1016/j.mpmed.2016.07.011</u>
- Colzato, L. S., Hommel, B., & Shapiro, K. L. (2010). Religion and the attentional blink: Depth of faith predicts depth of the blink. *Frontiers in Psychology*, 1, 147. https://doi.org/10.3389/fpsyg.2010.00147
- Colzato, L. S., van den Wildenberg, W. P., & Hommel, B. (2008). Losing the big picture: How religion may control visual attention. *PLoS One*, 3(11), e3679. https://doi.org/10.1371/journal.pone.0003679
- Condillac, E. B. (1746/1971): An essay on the origin of human knowledge. Facsimiles and Reprints.
- Cooper, N., Kable, J. W., Kim, B. K. & Zauberman, G. (2013). Brain activity in valuation regions while thinking about the future predicts individual discount rates. *The Journal of Neuroscience*, 33(32), 13150-13156. <u>https://doi.org/10.1523/JNEUROSCI.0400-13.2013</u>
- Cooperrider, K., & Núñez, R. (2009). Across time, across the body. Transversal temporal gestures. *Gesture*, 9(2), 181-206. <u>https://doi.org/10.1075/gest.9.2.02coo</u>
- Cottle, T. J. (1967). The circles test: An investigation of perceptions of temporal relatedness and dominance. Journal of Projective Techniques and Personality Assessment, 31(5), 58-71. <u>https://doi.org/10.1080/0091651X.1967.10120417</u>
- Cravo, A. M., de Azevedo, G. B., Moraes Bilacchi Azarias, C., Barne, L. C., Bueno,F. D., de Camargo, R. Y., ... & de Azevedo Neto, R. M. (2022). Time experience during social distancing: A longitudinal study during the first

months of COVID-19 pandemic in Brazil. *Science advances*, 8(15), eabj7205. https://doi.org/10.1126/sciadv.abj7205

- Croote, D. E., Lai, B., Hu, J., Baxter, M. G., Montagrin, A., & Schiller, D. (2020). Delay discounting decisions are linked to temporal distance representations of world events across cultures. *Scientific reports*, 10(1), 1-13. https://doi.org/10.1038/s41598-020-69700-w
- D'Andrade, R. G. (1995). *The development of cognitive anthropology*. Cambridge University Press.
- de la Fuente, J., Santiago, J., Román, A., Dumitrache, C., & Casasanto, D. (2014). When you think about it, your past is in front of you: How culture shapes spatial conceptions of time. *Psychological Science*, 25(9), 1682–1690. <u>https://doi.org/10.1177/0956797614534695</u>
- Dehaene, S., Bossini, S., & Giraux, P. (1993). The mental representation of parity and number magnitude. *Journal of Experimental Psychology: General*, 122(3), 371– 396. <u>https://doi.org/10.1037/0096-3445.122.3.371</u>
- Dahl, Ø. (1995). When the future comes from behind: Malagasy and other time concepts and some consequences for communication. *International Journal ofIntercultural Relations*, 19, 197–209. <u>https://doi.org/10.1016/0147-1767(95)00004-U</u>
- Das, T. K. (1987). Strategic planning and individual temporal orientation. *Strategic management journal*, 8(2), 203-209. https://doi.org/10.1002/smj.4250080211

Dixon-Kennedy, M. (1998). Encyclopedia of Greco-Roman Mythology. ABC-CLIO, Inc

- Dobosz, D., Gierczyk, M., Janiak, A., Piasecki, D., & Rajba, B. (2022). Transformations of Religiosity during the SARS-CoV-2 Pandemic — on the example of catholic religious practices of Polish students. *Religions*, 13(4), 308. <u>https://doi.org/10.3390/rel13040308</u>
- Dolscheid, S., Shayan, S., Majid, A., & Casasanto, D. (2013). The thickness of musical pitch: Psychophysical evidence for linguistic relativity. *Psychological Science*, 24(5), 613–621. <u>https://doi.org/10.1177/0956797612457374</u>
- Doob, L. W. (1971). Patterning of time. Yale University Press.
- Doppler, C. (1842). Über das farbige Licht der Doppelsterne und einiger anderer Gestirne des Himmels (About the coloured light of the binary stars and some other

stars of the heavens). Abhandlungen der Königl. Böhm. Gesellschaft der Wissenschaften (V. Folge, Bd. 2, S. 465–482).

Dušanić, S. (2007). Psihološka istraživanja religioznosti. Filozofski fakultet.

- Egbert, N., Mickley, J., & Coeling, H. (2004). A review and application of social scientific measures of religiosity and spirituality: Assessing a missing component in health communication research. *Health Communication*, 16(1), 7-27. <u>https://doi.org/10.1207/S15327027HC1601_2</u>
- Ellis, S., McCullough, J., Wallendorf, M., & Tan, C. T. (1985). Cultural values and behavior: Chineseness within geographic boundaries. In E. Hirschman & M. B. Holbrook, (Eds.) *Advances in Consumer Research* (pp. 126-128). Association for Consumer Research.
- Ersner-Hershfield, H., Garton, M. T., Ballard, K., Samanez-Larkin, G. R., & Knutson, B. (2009). Don't stop thinking about tomorrow: Individual differences in future selfcontinuity account for saving. *Judgment and Decision Making*, 4(4), 280–286. <u>https://doi.org/10.1111/sjop.12358</u>
- Evans, V. (2004). *The Structure of time: Language, meaning, and temporal cognition.* John Benjamins.
- Evans, V. (2013). Language and time: A cognitive linguistics approach. Cambridge University Press.
- Eysenck, M. W., Payne, S., & Santos, R. (2006). Anxiety and depression: Past, present, and future events. *Cognition and Emotion*, 20(2), 274–294. <u>https://doi.org/10.1080/02699930500220066</u>
- Fairbanks, E. (2017, January 16). The last white Africans. *Foreign Policy*. Retrieved from https://foreignpolicy.com/2017/01/16/the-last-white-africans/
- Fillmore, C. (1971). Lectures on deixis. CSLI Publications.
- Fraisse, P. (1963). The psychology of time. Harper & Row.
- Frazer, J. G. (1932). Ovid's Fasti. American Journal of Philology, 53(2). https://doi.org/ 10.2307/289815
- Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time discounting and time preference: A critical review. *Journal of Economic Literature*, 40, 351-401. <u>https://doi.org/10.1257/002205102320161311</u>

- Fujita, K., Henderson, M. D., Eng, J., Trope, Y., & Liberman, N. (2006). Spatial Distance and Mental Construal of Social Events. *Psychological Science*, 17(4), 278-282. <u>https://doi.org/10.1111/j.1467-9280.2006.01698.x</u>
- Fuhrman, O., & Boroditsky, L. (2010). Cross-cultural differences in mental representations of time: Evidence from an implicit nonlinguistic task. *Cognitive Science*, 34(8), 1430-1451. <u>https://doi.org/10.1111/j.1551-6709.2010.01105.x</u>
- Galang, J. R. F. (2021). Science and religion for COVID-19 vaccine promotion. *Journal of Public Health*, 43(3), e513–e514. <u>https://doi.org/10.1093/pubmed/fdab128</u>
- Gale, R. (Ed.). (2016). The philosophy of time: A collection of essays. Springer.
- Gallese, V. (2008). Mirror neurons and the social nature of language: The neural exploitation hypothesis. Social neuroscience, 3(3-4), 317-333. <u>https://doi.org/10.1080/17470910701563608</u>
- Gallese, V., & Lakoff, G. (2005). The brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive neuropsychology*, 22(3-4), 455-479. <u>https://doi.org/10.1080/02643290442000310</u>
- Gallois, W. (2007). Time, Religion and History. Pearson Education.
- Gan, Y., Miao, M., Zheng, L., & Liu, H. (2017). Temporal Doppler Effect and future orientation: Adaptive function and moderating conditions. *Journal of Personality*, 85(3), 313–325. <u>https://doi.org/10.1111/jopy.12242</u>
- Ganiel, G. (2021). Online Opportunities in Secularizing Societies? Clergy and the COVID-19 Pandemic in Ireland. *Religions*, 12(6), 437. <u>https://doi.org/10.3390/rel12060437</u>
- Gao, X. (2016). Cultural differences between East Asian and North American in temporal orientation. *Review of General Psychology*, 20(1), 118–127. <u>https://doi.org/10.1037/gpr0000070</u>
- Gell, A. (1992). *The anthropology of time: Cultural constructions of temporal maps and images*. Explorations in anthropology. Berg.
- Gell, A. (2021). *The anthropology of time: Cultural constructions of temporal maps and images*. Routledge.
- Germano, G., & Brenlla, M. E. (2022). Adaptación argentina de la Escala de Foco Temporal y evaluación de sus propiedades psicométricas. *Perspectivas en Psicología*, 19(1), 81-102.

Gibbs, R. W. Jr. (2006). *Embodiment and cognitive science*. Cambridge University Press.Giddens, A. (2003). *Runaway world: How globalization is reshaping our lives*. Taylor & Francis.

- Gill, A., & Lundsgaarde, E. (2004). State welfare spending and religiosity: A crossnational analysis. *Rationality and Society*, 16(4), 399-436. <u>https://doi.org/10.1177/1043463104046694</u>
- Gilpin, A. (1993). Table for conversion of Kendall's tau to Spearman's rho within the context of measures of magnitude of effect for meta-analysis. *Educational and Psychological Measurement*, 53(1), 87-92. https://doi:10.1177/0013164493053001007
- Glenberg, A. M. (1997). What memory is for: Creating meaning in the service of action. Behavioral and brain sciences, 20(1), 41-50. <u>https://doi.org/10.1017/S0140525X97470012</u>
- Gozli, D. G., Chow, A., Chasteen, A. L., & Pratt, J. (2013). Valence and vertical space: Saccade trajectory deviations reveal metaphorical spatial activation. *Visual Cognition*, 21(5), 628-646. https://doi.org/10.1080/13506285.2013.815680
- Gracia, A., Cruz, B., Seo, Y. & Buchanan-oliver, M. (2017). Religion as a field of transcultural practices in multicultural marketplaces. *Journal of Business Research*, 0–1. <u>http://doi.org/10.1016/j.jbusres.2017.07.022</u>
- Grady, J. E. (2010). Metaphor. In D. Geeraerts & H. Cuyckens (Eds.), *The Oxford handbook of cognitive linguistics*. Oxford University Press. <u>https://doi.org/10.1093/oxfordhb/9780199738632.013.0008</u>
- Graham, R. J. (1981). The role of perception of time in consumer research. *Journal of consumer research*, 7(4), 335-342. <u>https://doi.org/10.1086/208823</u>
- Graham, L. (2018). Did ancient peoples of Egypt and the Near East really imagine themselves as facing the past, with the future behind them? <u>https://doi.org/10.17613/y2ga-7b42</u>
- Grebe, M. E. (1990). Concepción del tiempo en la cultura aymara: representaciones icónicas, cognición y simbolismo. *Revista Chilena de Antropología*, (9), 63-81.
- Gu, Y., Zheng, Y., & Swerts, M. (2019). Which is in front of Chinese people, past or future? The effect of language and culture on temporal gestures and spatial

conceptions of time. *Cognitive Science*, 43(12), e12804. https://doi.org/10.1111/cogs.12804

- Guo, T., Ji, L.-J., Spina, R., & Zhang, Z. (2012). Culture, temporal focus, and values of the past and the future. *Personality and Social Psychology Bulletin*, 38(8), 1030– 1040. <u>https://doi.org/10.1177/0146167212443895</u>
- Guo, T., & Spina, R. (2019). Cultural asymmetry between perceptions of past and future personal change. *Frontiers in Psychology*, 10. https://doi.org/10.3389/fpsyg.2019.00885
- Gutchess, A., & Rajaram, S. (2022). *Consideration of culture in cognition: how we can enrich methodology and theory*. PsyArXiv.<u>https://doi.org/10.31234/osf.io/64rnk</u>
- Hacic-Vlahović, A. (2008). Secularization in Bosnia-Herzegovina: an examination of religiosity trends in a multi-ethnic society. *Amsterdam Social Science*, 1(1), 72-86.
- Hall, E. T., & Hall, T. (1959). The silent language. Anchor books.
- Haman, J., & Avery, M. (2019). ciTools: Confidence or prediction intervals, quantiles, and probabilities for statistical models (R Package Version 0.5.1) [Computer software]. Retrieved from <u>https://CRAN.R-project.org/package=ciTools</u>
- Hardisty, D. J., & Weber, E. U. (2009). Discounting future green: Money versus the environment. *Journal of Experimental Psychology: General*, 138(3), 329–340. <u>https://doi.org/10.1037/a0016433</u>
- Haspelmath, M. (1997). From space to time: Temporal adverbials in the world's languages. Lincom Europa.
- Hayes, A. F., & Coutts, J. J. (2020). Use omega rather than Cronbach's alpha for estimating reliability. But.... *Communication Methods and Measures*, 14(1), 1-24. <u>https://doi.org/10.1080/19312458.2020.1718629</u>
- Helzer, E. G., & Gilovich, T. (2012). Whatever is willed will be: a temporal asymmetry in attributions to will. *Personality and Social Psychology Bulletin*, 38(10), 1235– 1246. <u>https://doi.org/10.1177/0146167212448403</u>
- Henrich, J. (2020). *The WEIRDest people in the world: How the West became psychologically peculiar and particularly prosperous*. Penguin UK.
- Hibbert, P., & Huxham, C. (2010). The past in play: Tradition in the structures of collaboration. Organization Studies, 31(5), 525-554. <u>https://doi.org/10.1177/0170840610372203</u>

- Hill, T. D., Gonzalez, K., & Burdette, A. M. (2020). The blood of christ compels them: state religiosity and state population mobility during the Coronavirus (COVID-19) pandemic. *Journal of Religion and Health*, 59(5), 2229–2242. <u>https://doi.org/10.1007/s10943-020-01058-9</u>
- Hill, P. C., & Hood, R. W. (Eds.). (1999). *Measures of religiosity*. Birmingham, AL: Religious Education Press.
- Hill, P. C., & Pargament, K. I. (2003). Advances in the conceptualization and measurement of religion and spirituality: Implications for physical and mental health research. *American psychologist*, 58(1), 64. <u>https://doi.org/10.1037/0003-066X.58.1.64</u>
- Hofstede, G. (1980). Culture and organizations. *International studies of management & organization*, 10(4), 15-41. <u>https://doi.org/10.1080/00208825.1980.11656300</u>
- Hofstede, G. (1990). Cultures and organizations: Software of the mind. McGraw-Hill.
- Hofstede, G. (2001). Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations. SAGE.
- Hofstede, G., & Bond, M. H. (1988). The Confucius connection: From cultural roots to economic growth. Organizational dynamics, 16(4), 5-21. <u>https://doi.org/10.1016/0090-2616(88)90009-5</u>
- Holland, L. A. (1961). Janus and the Bridge. Papers and monographs of the American Academy in Rome.
- Holman, E. A., & Silver, R. C. (1998). Getting "stuck" in the past: Temporal orientation and coping with trauma. *Journal of Personality and Social Psychology*, 74(5), 1146–1163. <u>https://doi.org/10.1037/0022-3514.74.5.1146</u>
- Holmqvist, J., Guest, D., & Grönroos, C. (2015). The role of psychological distance in value creation. *Management Decision*, 53(7), 1430–1451. <u>https://doi.org/10.1108/MD-06-2014-0335/FULL/PDF</u>
- Hommel, B., & Colzato, L. S. (2010). Religion as a control guide: on the impact of religion on cognition. Zygon, 45(3), 596-604. <u>https://doi.org/10.1111/j.1467-9744.2010.01116.x</u>
- Hood Jr, R. W., Hill, P. C., & Spilka, B. (2018). *The psychology of religion: An empirical approach*. Guilford Publications.
- Horwich, P. (1987). Asymmetries in time: problems in the philosophy of science. MIT Press.

Hsu, F. L. (1948). Under the Ancestors' Shadow. Columbia University Press.

- Hulbert, R. J., & Lens, W. (1988). Time and self-identity in later life. *The International Journal of Aging and Human Development*, 27(4), 293-303. <u>https://doi.org/10.2190/3C7Y-0X0X-GEMC-BTWX</u>
- Inglehart, R. (2021). *Religion's sudden decline: What's causing it, and what comes next?* Oxford University Press.
- Inglehart, R., & Baker, W. E. (2000). Modernization, cultural change, and the persistence of traditional values. *American Sociological Review*, 65(1), 19–51. <u>https://doi.org/10.2307/2657288</u>
- Inglehart, R., & Welzel, C. (2005). *Modernization, cultural change and democracy: the human development sequence*. Cambridge University Press.
- James, W. (1890). The Principles of Psychology. Henry Holt & Co.
- Jaques, E. 1982. The form of time. Crane Russak.
- Jaspal, R., Lopes, B., & Lopes, P. (2020). Fear, social isolation and compulsive buying in response to COVID-19 in a religiously diverse UK sample. *Mental Health, Religion* & *Culture,* 23(5), 427-442. <u>https://doi.org/10.1080/13674676.2020.1784119</u>
- Ji, L. J., Guo, T., Zhang, Z., & Messervey, D. (2009). Looking into the past: Cultural differences in perception and representation of past information. *Journal of Personality and Social Psychology*, 96(4), 761–769. <u>https://doi.org/10.1037/a0014498</u>
- Ji, L., Hong, E. K., Guo, T., Zhang, Z., Su, Y., & Li, Y. (2019). Culture, psychological proximity to the past and future, and self-continuity. *European Journal of Social Psychology*, 49(4), 735–747. <u>https://doi.org/10.1002/ejsp.2544</u>

Johnson-Laird, P. N. (1983). Mental models. Cambridge University Press.

- Karniol, R., & Ross, M. (1996). The motivational impact of temporal focuse: Thinking about the future and the past. *Annual Review of Psychology*, 47(1), 593–620. <u>https://doi.org/10.1146/annurev.psych.47.1.593</u>
- Kim, Y. H., Cai, H., Gilliland, M., Chiu, C. Y., Xia, S., & Tam, K. P. (2012). Standing in the glory or shadow of the past self: Cultures differ in how much the past self affects current subjective well-being. *Emotion*, 12, 1111–1117. <u>http://dx.doi.org/10.1037/a0026968</u>

- Kirby, K. N., & Maraković, N. N. (1996). Delay-discounting probabilistic rewards: Rates decrease as amounts increase. *Psychonomic Bulletin and Review*, 3(1), 100–104. <u>https://doi.org/10.3758/BF03210748</u>
- Klein, H. (1987). The future precedes the past: Time in Toba. Word, 38, 173-185.
- Kluckhohn, F. R. & Strodtbeck, F. L. (1961). Variations in value orientations. Row, Peterson.
- Kane, J., Van Boven, L., & McGraw, A. P. (2012). Prototypical prospection: Future events are more prototypically represented and simulated than past events. *European Journal of Social Psychology*, 42(3), 354-362. <u>https://doi.org/10.1002/ejsp.1866</u>
- Ko, G., & Gentry, J. W. (1991). The development of time orientation measures for use in cross-cultural research. ACR North American Advances, 18, 135-142.
- Kozhukhovskaia, I. (2020). Boundary Symbolism and Dual Deities as Patrons in Ancient Navigation. Aspects of Ritual and Mythology. *Journal of Frontier Studies*, 5(3), 170-186. <u>https://doi.org/10.46539/jfs.v5i3.184</u>
- Kristal, A. C., O'Brien, E., & Caruso, E. M. (2019). Yesterday's news: A temporal discontinuity in the sting of inferiority. *Psychological Science*, 30(5), 643–656. <u>https://doi.org/10.1177/0956797619839689</u>
- Kroeber, A. L., & Kluckhohn, C. (1952). Culture: A critical review of concepts and definitions. Papers. Peabody Museum of Archaeology & Ethnology, Harvard University, 47(1), viii, 223.
- Kruglanski, A. W., Pierro, A., & Higgins, E. T. (2015). Experience of time by people on the Go: A theory of the locomotion–temporality interface. *Personality and Social Psychology Review*, 20(2), 100–117. <u>https://doi.org/10.1177/1088868315581120</u>
- Kvam, P. D., Baldwin, M., & Westgate, E. C. (2022). Cognitive mechanisms underlying subjective value of past and future events: Modeling systematic reversals of temporal value asymmetry. *Decision* <u>https://doi.org/10.31234/osf.io/5uc93</u>
- Lakens, D. (2012). Polarity correspondence in metaphor congruency effects: structural overlap predicts categorization times for bipolar concepts presented in vertical space. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 38(3), 726.
Lakoff, G., & Johnson, M. (1980). Metaphors we live by. University of Chicago Press.

- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to Western thought*. Basic Books.
- Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin*, 136(6), 1045–1067. <u>https://doi.org/10.1037/a0020970</u>
- Lammers, J., & Baldwin, M. (2018). Past-focused temporal communication overcomes conservatives' resistance to liberal political ideas. *Journal of Personality and Social Psychology*, 114(4), 599–619. https://doi.org/10.1037/pspi0000121.
- Laverty, K. J. (1996). Economic "short-termism": The debate, the unresolved issues, and the implications for management practice and research. Academy of Management Review, 21(3), 825-860. <u>https://doi.org/10.5465/amr.1996.9702100316</u>
- Le Guen, O., & Balam, L. I. P. (2012). No metaphorical time line in gesture and cognition among Yucatec Mayas. *Frontiers in Psychology*, 3(271), 1–15. <u>https://doi.org/10.3389/fpsyg.2012.00271</u>
- Lebois, L. A., Wilson-Mendenhall, C. D., & Barsalou, L. W. (2015). Are automatic conceptual cores the gold standard of semantic processing? The contextdependence of spatial meaning in grounded congruency effects. *Cognitive science*, 39(8), 1764-1801. <u>https://doi.org/10.1111/cogs.12174</u>
- Lee, S., Lee, A. Y., & Kern, M. C. (2011). Viewing time through the lens of the self: The fit effect of self-construal and temporal distance on task perception. *European Journal of Social Psychology*, 41, 191–200. <u>http://dx.doi.org/10.1002/ejsp.765</u>
- Lewin, K. (1951). In D. Cartwright (Ed.), *Field theory in social science; Selected theoretical papers*. Harper & Row.
- Li, H. (2018). Time on hands. *Gesture*, 16(3), 396–415. https://doi.org/10.1075/gest.00002.1i
- Li, H. (2021). Time heals all wounds: analysis of changes in temporal focus and implicit space-time mappings among survivors of the 2019 China earthquake over time. *Language and Cognition*, 13(4), 595-612. <u>https://doi.org/10.1017/langcog.2021.14</u>
- Li, H., & Cao, Y. (2017). Personal attitudes toward time: The relationship between temporal focus, space-time mappings and real life experiences. *Scandinavian Journal of Psychology*, 58, 193–198. <u>https://doi.org/10.1111/sjop.12358</u>

- Li, H., & Cao, Y. (2018a). The hope of the future: The experience of pregnancy influences women's implicit space–time mappings. *The Journal of Social Psychology*, 158(2), 152-156. <u>https://doi.org/10.1080/00224545.2017.1297289</u>
- Li, H., & Cao, Y. (2018b). Time will tell: Temporal landmarks influence metaphorical associations between space and time. *Cognitive Linguistics*, 29(4), 677–701. <u>https://doi.org/10.1515/cog-2017-0043</u>
- Li, H., & Cao, Y. (2018c). Karma or immortality: Can religion influence space-time mappings?. *Cognitive Science*, 42(3), 1041-1056. <u>https://doi.org/10.1111/cogs.12579</u>
- Li, H., & Cao, Y. (2019). Planning for the Future: The Relationship between Conscientiousness, Temporal Focus and Implicit Space-Time Mappings. *Personality and Individual Differences, 141,* 111–116. https://doi.org/10.1016/j.paid.2018.12.031
- Li, H., & Cao, Y. (2020a). Time for politics: The relationship between political attitude and implicit space-time mappings. *Current Psychology*, 41, 1184–1190. <u>https://doi.org/10.1007/s12144-020-00640-4</u>
- Li, H., & Cao, Y. (2020b). Best wishes for the future: The link between dispositional optimism and mental sagittal space-time mappings. *Personality and Individual Differences*, 166(May), 110212. <u>https://doi.org/10.1016/j.paid.2020.110212</u>
- Li, H., & Cao, Y. (2021a). In times of illness: Covid-19 threat influences temporal focus and implicit space-time mappings. *Personality and Individual Differences*, 171, 110561. <u>https://doi.org/10.1016/j.paid.2020.110561</u>
- Li, H., & Cao, Y. (2021b). Move with the flow: Metaphorical perspectives on time in Chinese Taoists and atheists. *The international journal for the psychology of religion*, 31(4), 225-234. <u>https://doi.org/10.1080/10508619.2020.1825174</u>
- Li, H., VanBui, Q., &Cao, Y. (2018). One country, two cultures: Implicit space-time mappings in Southern and Northern Vietnamese. European Journal of Social Psychology, 48,560–565. https://doi.org/10.1002/ejsp.2356
- Liberman, N., Sagristano, M. D., & Trope, Y. (2002). The effect of temporal distance on level of mental construal. *Journal of experimental social psychology*, 38(6), 523-534. <u>https://doi.org/10.1016/S0022-1031(02)00535-8</u>

Liberman, N., & Trope, Y. (1998). The role of feasibility and desirability considerations in near and distant future decisions: A test of temporal construal theory. *Journal of personality and social psychology*, 75(1), 5. <u>https://doi.org/10.1037/0022-</u> 3514.75.1.5

Liebeschuetz, J. (1979). *Continuity and Change in Roman Religion*. Oxford University Press.

- Liefgreen, A., Dalton, M. A., & Maguire, E. A. (2020). Manipulating the temporal locus and content of mind-wandering. *Consciousness and Cognition*, 79(February), 102885. <u>https://doi.org/10.1016/j.concog.2020.102885</u>
- Liu, K., Chen, Y., Lin, R., & Han, K. (2020). Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. *Journal of Infection*, 80(6), e14–e18. <u>https://doi.org/10.1016/J.JINF.2020.03.005</u>
- Loeffler, J., Raab, M., & Cañal-Bruland, R. (2017). Does movement influence representations of time and space? *PLoS ONE*, 12(4). https://doi.org/10.1371/journal.pone.0175192
- Łowicki, P., Witowska, J., Zajenkowski, M., & Stolarski, M. (2018). Time to believe: Disentangling the complex associations between time perspective and religiosity. *Personality and Individual Differences*, 134, 97-106. <u>https://doi.org/10.1016/j.paid.2018.06.001</u>
- Macrae, C. N., Miles, L. K., & Best, S. B. (2012). Moving through time. Mental time travel and social behavior. In J. P. Forgas, K. Fiedler & C. Sedikides (Eds.), *Social Thinking and Interpersonal Behavior* (113-126). Psychology Press.
- Maddux, W. W., & Yuki, M. (2006). The "ripple effect": Cultural differ- ences in perceptions of the consequences of events. *Personality and Social Psychology Bulletin*, 32, 669–683. http://dx.doi.org/10.1177/0146167205283840
- Mahamid, F. A., & Bdier, D. (2021). The association between positive religious coping, perceived stress, and depressive symptoms during the spread of coronavirus (COVID-19) among a sample of adults in Palestine: Across sectional study. *Journal* of religion and health, 60(1), 34-49. <u>https://doi.org/10.1007/s10943-020-01121-5</u>
- Majid, A., Gaby, A., & Boroditsky, L. (2013). Time in terms of space. *Frontiers in psychology*, *4*, 554. <u>https://doi.org/10.3389/fpsyg.2013.00554</u>

- Marginson, D., & McAulay, L. (2008). Exploring the debate on short-termism: A theoretical and empirical analysis. *Strategic management journal*, 29(3), 273-292. <u>https://doi.org/10.1002/smj.657</u>
- Markus, H. (1977). Self-schemata and processing information about the self. Journal of Personality and Social Psychology, 35, 63–78. <u>https://doi.org/10.1037/0022-3514.35.2.63</u>
- Markus, H.R., & Kitayama, S. (1994). A collective fear of the collective: Implications forselves and theories of selves. *Personality and Social Psychology Bulletin*, 20, 568–579. <u>https://doi.org/10.1177/014616729420501</u>
- Marcus, Z. J., & McCullough, M. E. (2021). Does religion make people more selfcontrolled? A review of research from the lab and life. *Current opinion in psychology*, 40, 167-170. <u>https://doi.org/10.1016/j.copsyc.2020.12.001</u>

Merleau-ponty, M. (1945/1962): Phenomenology of perception. Routledge.

- Merleau-ponty, M. (2003): *The nature: Course notes from the Collège de France*. Northwestern University Press
- Meza, D. (2020). In a pandemic are we more religious? Traditional practices of catholics and the COVID-19 in Southwestern Colombia. *International Journal of Latin American Religions*, 4(2), 218-234. <u>https://doi.org/10.1007/s41603-020-00108-0</u>
- McCrink, K., Caldera, C., & Shaki, S. (2018). The early construction of spatial attention: culture, space, and gesture in parent–child interactions. *Child Development*, 89(4), 1141-1156. <u>https://doi.org/10.1111/cdev.12781</u>
- McDougle, L., Konrath, S., Walk, M., & Handy, F. (2016). Religious and secular coping strategies and mortality risk among older adults. *Social Indicators Research*, 125(2), 677-694. https://doi.org/10.1007/s11205-014-0852-y
- McGrath, J. E., & Kelly, J. R. (1986). *Time and human interaction: Toward a social psychology of time*. Guilford Press.
- McGrath, R. E., & Meyer, G. J. (2006). When effect sizes disagree: The case of r and d. *Psychological Methods*, 11(4), 386–401. <u>https://doi.org/10.1037/1082-989X.11.4.386</u>
- McNeill, D. (2008). Gesture and thought. In *Gesture and Thought*. University of Chicago press.
- McTaggart, J. E. (1908). The unreality of time. *Mind*, 68, 457-474. <u>https://www.jstor.org/stable/2248314</u>

- Mell, H., Baumard, N., & André, J. B. (2021). Time is money. Waiting costs explain why selection favors steeper time discounting in deprived environments. *Evolution and Human Behavior*, 42(4), 379-387. <u>https://doi.org/10.1016/j.evolhumbehav.2021.02.003</u>
- Miles, L. K., Betka, E., Pendry, L. F., & Macrae, C. N. (2010). Mapping temporal constructs: Actions reveal that time is a place. *Quarterly Journal of Experimental Psychology*, 63(11), 2113–2119. https://doi.org/10.1080/17470218.2010.524932
- Miles, L. K., Karpinska, K., Lumsden, J., & Macrae, C. N. (2010). The meandering mind: Vection and mental time travel. *PloS one*, 5(5), e10825. <u>https://doi.org/10.1371/journal.pone.0010825</u>
- Miles, L., Nind, L., & Macrae, C. (2010). Moving through time. *Psychological Science*, 21(2), 222. <u>https://doi.org/10.1177/0956797609359333</u>
- Milfont, T. L., & Gouveia, V. V. (2006). Time perspective and values: An exploratory study of their relations to environmental attitudes. *Journal of Environmental Psychology*, 26(1), 72–82. https://doi.org/10.1016/j.jenvp.2006.03.001
- Mok, C., & DeFranco, A. L. (2000). Chinese cultural values: Their implications for travel and tourism marketing. *Journal of Travel & Tourism Marketing*, 8(2), 99-114. <u>https://doi.org/10.1300/J073v08n02_07</u>
- Molouki, S., Hardisty, D. J., & Caruso, E. M. (2019). The sign effect in past and future discounting. *Psychological Science*, 30(12), 1674–1695. <u>https://doi.org/10.1177/0956797619876982</u>
- Molteni, F., Ladini, R., Biolcati, F., Chiesi, A. M., Dotti Sani, G. M., Guglielmi, S., ... & Vezzoni, C. (2021). Searching for comfort in religion: insecurity and religious behaviour during the COVID-19 pandemic in Italy. *European Societies*, 23(sup1), S704-S720. <u>https://doi.org/10.1080/14616696.2020.1836383</u>
- Moore, K. E. (2006). Space-to-time mappings and temporal concepts. *Cognitive Linguistics*, 17(2), 199–244. <u>https://doi.org/10.1515/COG.2006.005</u>
- Moore, K. E. (2014). The spatial language of time. Amsterdam: John Benjamins press.
- Núñez, R., & Cooperrider, K. (2013). The tangle of space and time in human cognition.TrendsinCognitiveSciences,17(5),220–229.https://doi.org/10.1016/j.tics.2013.03.008

- Munn, N. D. (1992). The cultural anthropology of time: A critical essay. *Annual Review of Anthropology*, *21*, 93-123. https://www.jstor.org/stable/2155982
- Nuttin, J. (2014). *Future time perspective and motivation: Theory and research method*. Psychology Press.
- Nakagawa, S., Johnson, P. C. D., & Schielzeth, H. (2017). The coefficient of determination R2 and intra-class correlation coefficient from generalized linear mixed-effects models revisited and expanded. *Journal of the Royal Society Interface*, 14(134), 20170213. <u>https://doi.org/10.1098/rsif.2017.0213</u>
- Nakagawa, S., & Schielzeth, H. (2013). A general and simple method for obtaining R2 from generalized linear mixed-effects models. *Methods in Ecology and Evolution*, 4(2), 133–142. <u>https://doi.org/10.1111/j.2041-210x.2012.00261.x</u>
- Nevins, J. L., Bearden, W. O., & Money, B. (2007). Ethical values and long-term orientation. *Journal of Business Ethics*, 71(3), 261-274. <u>https://doi.org/10.1007/s10551-006-9138-x</u>
- Newby-Clark, I. R., & Ross, M. (2003). Conceiving the past and future. Personality and Social *Psychology Bulletin*, 20, 807-818. <u>https://doi.org/10.1177/014616720302900700</u>
- Newson, M., Buhrmester, M., Xygalatas, D., & Whitehouse, H. (2018). Go WILD, Not WEIRD. Journal for the Cognitive Science of Religion, 6(1-2), 80-106. <u>https://doi.org/10.1558/jcsr.38413</u>
- Nichols, S., Strohminger, N., Rai, A., & Garfield, J. (2018). Death and the self. *Cognitive science*, 42, 314-332. <u>https://doi.org/10.1111/cogs.12590</u>
- Nisbet, R. (1979). The idea of progress. *Literature of Liberty*, January/March 1979, vol. 2, No.1, retrieved from https://oll.libertyfund.org/title/liggio-literature-of-liberty-january-march-1979-vol-2-no-1.
- Nisbett, R. E., Peng, K., Choi, I., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review*, 108(2), 291– 310. <u>https://doi.org/10.1037/0033-295X.108.2.291</u>
- Norenzayan, A., & Hansen, I. G. (2006). Belief in supernatural agents in the face of death. *Personality and Social Psychology Bulletin*, 32(2), 174-187 <u>https://doi.org/10.1177/0146167205280251</u>

- Norris, P., & Inglehart, R. (2011). *Sacred and secular: Religion and politics worldwide*. Cambridge University Press.
- Núñez, R., & Cooperrider, K. (2013). The tangle of space and time in human cognition.TrendsinCognitiveSciences,17(5),220–229.https://doi.org/10.1016/j.tics.2013.03.008
- Núñez, R., Cooperrider, K., Doan, D., & Wassmann, J. (2012). Contours of time: Topographic construals of past, present, and future in the Yupno valley of Papua New Guinea. *Cognition*, 124(1), 25–35. <u>https://doi.org/10.1016/j.cognition.2012.03.007</u>
- Núñez, R., Motz, B., & Teuscher, U. (2006). Time after time: The psychological reality of the Ego- and Time-Reference-Point distinction in metaphorical construals of time. *Metaphor and Symbol*, 21(3), 133-146. https://doi.org/10.1207/s15327868ms2103 1
- Núñez, R., & Sweetser, E. (2006). With the future behind them: Convergent evidence from Aymara language and gesture in the crosslinguistic comparison of spatial construals of time. *Cognitive Science*, 30(3), 401–450. <u>https://doi.org/10.1207/s15516709cog0000 62</u>
- Ogilvie, R. (1969). *The Romans and their Gods in the Age of Augustus*. W.W. Norton & Company.
- O'Keefe, M. (2021). *The Significance of Janus During the Augustan Principate* (Doctoral dissertation). Retrieved from http://jbox.gmu.edu/handle/1920/12129
- Ouellet, M., Santiago, J., Israeli, Z., & Gabay, S. (2010). Is the future the right time? *Experimental Psychology*, 57(4), 308–314. <u>https://doi.org/10.1027/1618-3169/a000036</u>
- Ovid (12/1931) *Fasti*. Translated by Frazer, J. G., Loeb Classical Library Volume. Harvard University Press.
- Paglieri, F., Borghi, A. M., Colzato, L. S., Hommel, B. & Scorolli, C. (2013). Heaven can wait. How religion modulates temporal discounting. *Psychological Research*, 77(6), 738–747. <u>http://doi.org/10.1007/s00426-012-0473-5</u>
- Paneth, L. (1953) La symbolique des nombres dans inconscient. Payot.
- Pargament, K (1997). The Psychology of Religion and Coping: Theory, Research, Practice. Guilford.

- Park, C. L., & Cohen, L. H. (1993). Religious and nonreligious coping with the death of a friend. *Cognitive therapy and research*, 17(6), 561-577. <u>https://doi.org/10.1007/BF01176079</u>
- Parsons, T., & Shils, E. A. (1951). Values, motives, and systems of action. *Toward a general theory of action*, *33*, 247-275. <u>https://doi.org/10.4159/harvard.9780674863507</u>
- Pecher, D., Boot, I., & Dantzig, S.V. (2011). Abstract concepts: sensory-motor grounding, metaphors, and beyond. *Psychology of Learning and Motivation*, 54, 217-248. https://doi.org/10.1016/B978-0-12-385527-5.00007-3
- Pew Research Center (2018). June 13, 2018. *The Age Gap in Religion around the World*. Retrieved from <u>https://www.pewforum.org/2018/06/13/young-adults-around-the-world-are-less-religious-by-several-measures/</u>
- Pew Research Center (2020a). *The Global God Divide*. July 20, 2929. Retrieved from https://www.pewresearch.org/global/2020/07/20/the-global-god-divide/
- Pew Research Center (2020b). Few Americans say their house of worship is open, but a quarter say their faith has grown amid pandemic. Pew Research Center. April 30th 2020. Retrieved from <u>https://www.pewresearch.org/fact-tank/2020/04/30/few-americans-say-their-house-of-worship-is-open-but-a-quarter-say-their-religious-faith-has-grown-amid-pandemic/</u>
- Pew Research Center (2020c). Pew Research Center's American News Pathways data

 tool.
 Retrieved
 from
 <u>https://www.pewresearch.org/pathways-</u>

 2020/COVID_ACT_R_c/age/us_adults
- Pew Research Center (2021), More Americans Than People in Other Advanced Economies Say COVID-19 Has Strengthened Religious Faith. January, 2021. Retrieved from <u>https://www.pewforum.org/2021/01/27/more-americans-than-people-in-other-advanced-economies-say-covid-19-has-strengthened-religious-faith/</u>
- Pitta, D. A., Fung, H. G., & Isberg, S. (1999). Ethical issues across cultures: Managing the differing perspectives of China and the USA. *Journal of Consumer Marketing*, 16, 240–256. <u>http://dx.doi.org/10.1108/07363769910271487</u>
- Plohl, N., & Musil, B. (2021). Modeling compliance with COVID-19 prevention guidelines: The critical role of trust in science. *Psychology, Health & Medicine*. 26(1), 1–12. <u>https://doi: 10.1080/13548506.2020.1772988</u>

- Pope, D. A., Poe, L., Stein, J. S., Snider, S. E., Bianco, A. G., & Bickel, W. K. (2019). Past and future preference reversals are predicted by delay discounting in smokers and non-smokers. *Experimental and clinical psychopharmacology*, 27(1), 19. <u>https://doi.org/10.1037/pha0000224</u>
- Preis, T., Moat, H. S., Stanley, H. E., & Bishop, S. R. (2012). Quantifying the advantage of looking forward. *Scientific reports*, 2(1), 1-2. https://doi.org/10.1038/srep00350
- Purcell, N. (2022). Janus. Oxford Classical Dictionary. Retrieved 13 Oct. 2022, from https://oxfordre.com/classics/view/10.1093/acrefore/9780199381135.001.0001/ac refore-9780199381135-e-3482.
- Purzycki, B. G., Apicella, C., Atkinson, Q. D., Cohen, E., McNamara, R. A., Willard, A. K., ... Huici, C. (2016). Cross-cultural dataset for the evolution of religion and morality project. *Scientific Data*, *3*, 160099. <u>http://doi.org/10.1038/sdata.2016.99</u>
- Qin, Y. (2021). Putting time in context: There is no causal link between temporal
focus and implicit space-time mappings on the front-back axis. Australian
Journal of Linguistics, 41(2), 152-165.
https://doi.org/10.1080/07268602.2021.1920885
- Quoidbach, J., Gilbert, D. T., & Wilson, T. D. (2013). The end of history illusion. Science, 339, 96–98. <u>https://doi.org/10.1126/science.1229294</u>
- R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <u>https://www.R-project.org/</u>
- Rad, M. S., Martingano, A. J., & Ginges, J. (2018). Toward a psychology of Homo sapiens: Making psychological science more representative of the human population. *Proceedings of the National Academy of Sciences*, 115(45), 11401-11405. <u>https://doi.org/10.1073/pnas.1721165115</u>
- Radden, G. (2004). The metaphor TIME AS SPACE across languages. In Uebersetzen, Interkulturelle Kommunikation, Spracherwerb und Sprachvermittlung—Das Leben mit mehreren Sprachen: Festschrift fuer Juliane House zum 60. Geburtstag (pp. 225–238). AKS-Verlag.
- Rappaport, H. (1990) Marking time. Simon & Schuster.
- Renneboog, L., & Spaenjers, C. (2012). Religion, economic attitudes, and household finance. Oxford economic papers, 64(1), 103-127. <u>https://doi.org/10.1093/oep/gpr025</u>

Ricoeur, P. (1979a). El Tiempo y las Filosofías. Salamanca. Ediciones Sígueme.

Ricoeur, P. (1979b). Las Culturas y el Tiempo. Salamanca. Ediciones Sígueme.

- Riegel, U., & Unser, A. (2021). Religious and Secular Coping Strategies of Reappraisal: Validating a Secular Supplement to the Reappraisal-Dimensions of RCOPE. *Journal of Empirical Theology*, 34(1), 29-48. <u>https://doi.org/10.1163/15709256-12341422</u>
- Rinaldi, L., Locati, F., Parolin, L., & Girelli, L. (2017). Distancing the present self from the past and the future: Psychological distance in anxiety and depression. *Quarterly Journal of Experimental Psychology*, 70(7), 1106–1113. <u>https://doi.org/10.1080/17470218.2016.1271443</u>
- Rioux, P.-A., Chaumon, M., Demers, A., Fitzback-Fortin, H., Kübel, S. L., Lebrun, C., Mendoza-Duran, E., Micillo, L., Racine, C., Thibault, N., Wassenhove, V. van, & Grondin, S. (2022). Psychological Time during the COVID-19 Lockdown: Canadian Data. *Timing & Time Perception*, 10(4), 326-343. https://doi.org/10.1163/22134468-bja10063
- Roman, L., & Roman, M. (2010). Encyclopedia of Greek and Roman Mythology. Facts on File Inc.
- Ross, M., & Newby-Clark, I. R. (1998). Construing the past and future. *Social Cognition*, *16*(1), 133–150. https://doi.org/10.1521/soco.1998.16.1.133
- Rüsen, J. (2004) Historical Consciousness: Narrative structure, moral function, and ontogenetic development. In P. Seixas (Ed.), *Theorizing historical consciousness*. University of Toronto Press.
- Ruthven, M. (2005). Fundamentalism: The search for meaning. Oxford University Press.
- Rutt, J. L., & Löckenhoff, C. E. (2016). From past to future: Temporal self-continuity across the life span. *Psychology and Aging*, *31*(6), 631–639. <u>https://doi.org/10.1037</u>
- Safranski, R. (2017). *Tiempo: la dimensión temporal y el arte de vivir*. Tusquets Editores SA.
- Santiago, J. (2022). ¿Cómo pensamos sobre el tiempo? In J. A., León, A. Domínguez & M. A. Alonso (Eds.). *Neurocognición y Lenguaje*. Editorial Médica Panamericana.

- Santiago, J., Lupiáñez, J., Pérez, E., & Funes, M. J. (2007). Time (also) flies from left to right. *Psychonomic Bulletin & Review*, 14(3), 512–516. https://doi.org/10.3758/BF03194099
- Santiago, J., Ouellet, M., Román, A., & Valenzuela, J. (2012). Attentional factors in conceptual congruency. *Cognitive Science*, 36(6), 1051–1077. <u>https://doi.org/10.1111/j.1551-6709.2012.01240.x</u>
- Santiago, J., Román, A., & Ouellet, M. (2011). Flexible foundations of abstract thought: A review and a theory. In A. Maass & T. W. Schubert (Eds.), *Spatial dimensions of social thought* (pp. 41–110). Mouton de Gruyter.
- Santiago, J., Román, A., Ouellet, M., Rodríguez, N., & Pérez-Azor, P. (2010). In hindsight, life flows from left to right. *Psychological Research PRPF*, 74(1), 59-70. <u>https://doi.org/10.1007/s00426-008-0220-0</u>
- Sapir, E. (1921/1949). Language. In D. Mandelbaum (Ed.), Culture, language, and personality: Selected essays (pp. 1–44). University of California Press.
- Saroglou, V., & Cohen, A. B. (2011). Psychology of culture and religion: Introduction to the JCCP special issue. *Journal of Cross-Cultural Psychology*, 42(8), 1309-1319. <u>https://doi.org/10.1177/0022022111412254</u>
- Saroglou, V., Delpierre, V., & Dernelle, R. (2003). Values and religiosity: A metaanalysis of studies using Schwartz's model. *Personality and Individual Differences*, 37(4), 721–734. <u>https://doi.org/10.1016/j.paid.2003.10.005</u>
- Schnabel, L., & Schieman, S. (2021). Religion protected mental health but constrained crisis response during crucial early days of the COVID-19 pandemic. *Journal for the Scientific Study of Religion*, 61(2), 530-543. <u>https://doi.org/10.1111/JSSR.12720</u>
- Schwartz, S. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. Advances in Experimental Social Psychology, 25,1–65. <u>https://doi.org/10.1016/S0065-2601(08)60281-6</u>
- Schwartz, S. H. (1999). A theory of cultural values and some implications for work. *Applied psychology*, 48(1), 23-47.
- Schwartz, S. H. (2006). A theory of cultural value orientations: Explication and applications. *Comparative sociology*, 5(2-3), 137-182. <u>https://doi.org/10.1163/156913306778667357</u>

- Schwartz, S., & Huismans, S. (1995). Value Priorities and Religiosity in Four Western Religions. Social Psychology Quarterly, 58(2), 88–107. https://doi.org/10.2307/2787148
- Sedikides, C., Hong, E. K., & Wildschut, T. (2022). Self-Continuity. Annual Review of Psychology, 74(1). <u>https://doi.org/10.1146/ANNUREV-PSYCH-032420-032236</u>
- Seligman, M. E., Railton, P., Baumeister, R. F., & Sripada, C. (2016). Homo prospectus. Oxford University Press.
- Sells, M. (2003). Crosses of blood: Sacred space, religion, and violence in Bosnia-Herzegovina. Sociology of Religion, 64(3), 309–331. https://doi.org/10.2307/3712487
- Semin, G. R., & Smith, E. R. (1999). Revisiting the past and back to the future: Memory systems and the linguistic representation of social events. *Journal of Personality* and Social Psychology, 76, 877–892. <u>https://doi.org/10.1037/0022-3514.76.6.877</u>
- Shils, E. (1981). Tradition. University of Chicago Press.
- Shipp, A. J., & Aeon, B. (2019). Temporal focus: Thinking about the past, present, and future. *Current Opinion in Psychology*, 26, 37–43. <u>https://doi.org/10.1016/j.copsyc.2018.04.005</u>
- Shipp, A. J., Edwards, J. R., & Lambert, L. S. (2009). Conceptualization and measurement of temporal focus: The subjective experience of the past, present, and future. Organizational Behavior and Human Decision Processes, 110(1), 1–22. <u>https://doi.org/10.1016/j.obhdp.2009.05.001</u>
- Shukor, S. A., & Jamal, A. (2013). Developing scales for measuring religiosity in the context of consumer research. *Middle East Journal of Scientific Research*. <u>https://doi.org/10.5829/idosi.mejsr.2013.13.1884</u>
- Si, K., Wyer, R. S., & Dai, X. (2016). Looking forward and looking back: The likelihood of an event's future reoccurrence affects perceptions of the time it occurred in the past. *Personality and Social Psychology Bulletin*, 42(11), 1577–1587. <u>https://doi.org/10.1177/0146167216665343</u>
- Sibley, C. G., & Bulbulia, J. (2012). Faith after an earthquake: A longitudinal study of religion and perceived health before and after the 2011 christchurch New Zealand earthquake. *PLoS ONE*, 7(12), e49648. <u>https://doi.org/10.1371/journal.pone.0049648</u>
- Siderits M. (2007). *Buddhism as Philosophy: An Introduction*. Hackett 300

- Sinha, C., Sinha, V. D. S., Zinken, J., & Sampaio, W. (2011). When time is not space: The social and linguistic construction of time intervals and temporal event relations in an Amazonian culture. *Language and Cognition*, 3(1), 137–169. https://doi.org/10.1515/LANGCOG.2011.006
- Sircova, A., Mitina, O. V., Boyd, J., Davydova, I. S., Zimbardo, P. G., Nepryaho, T. L., ... & Yasnaya, V. A. (2007). The phenomenon of time perspective across different cultures: Review of Researches Using ZTPI Scale. *Cultural-Historical Psychology*, 3(4), 19-31. <u>https://doi.org/10.17759/chp.2007030403</u>
- Smart, N. (1998). The world's religions. Cambridge University Press.
- Sommet, N., & Morselli, D. (2017). Keep calm and learn multilevel logistic modeling: A Simplified three-step procedure using Stata, R, Mplus, and SPSS. *International Review of Social Psychology*, 30(1), 203–218. <u>https://doi.org/10.5334/irsp.90</u>
- Souder, D., & Bromiley, P. (2012). Explaining temporal orientation: Evidence from the durability of firms' capital investments. *Strategic Management Journal*, 33(5), 550-569. <u>https://doi.org/10.1002/smj.970</u>
- Soriano, C. (2012): La metáfora conceptual. In I. Ibarretxe-Antuñano & J. Valenzuela (Eds.), *Lingüística Cognitiva* (97-121). Anthropos.
- Spears, N., Lin, X., & Mowen, J. C. (2001). Time orientation in the United States, China, and Mexico: Measurement and insights for promotional strategy. Journal of International Consumer Marketing, 13, 57-75. https://doi.org/10.1300/J046v13n01_05
- Starr, A., & Srinivasan, M. (2021). The future is in front, to the right, or below: Development of spatial representations of time in three dimensions. *Cognition*, 210, 104603. <u>https://doi.org/10.1016/j.cognition.2021.104603</u>
- Stevenson, H. W., & Stigler, J. W. (1992). *The learning gap: Why our schools are failing and what we can learn from Japanese and Chinese education.* Summit Books.
- Strathman, A., & Joireman, J. (2005). Understanding behavior in the context of time: Theory, research, and application. Lawrence Erlbaum
- Stieg, M. D., & Dixon, M. R. (2007). Discounting of past and future rewards of Texas Hold'em Gamblers. *European Journal of Behavior Analysis*, 8(1), 93–97. <u>https://doi.org/10.1080/15021149.2007.11434276</u>
- Suhler, C., & Callender, C. (2012). *Thank goodness that argument is over: Explaining the temporal value asymmetry*. University of Michigan Library.

- Sullivan, K., & Bui, L. T. (2016). With the future coming up behind them: Evidence that time approaches from behind in Vietnamese. *Cognitive Linguistics*, 27(2), 205–233. <u>https://doi.org/10.1515/cog-2015-0066</u>
- Tan, C. T., & McCullough, J. (1985). Relating Ethnic Attitudes and Consumption Values in Asian Context. In E. C. Hirschman & M. B. Holbrook (Eds.), *Advances in Consumer Research* (pp.: 122-125). Association for Consumer Research.
- Taylor, D. B. (2021, March 17). A Timeline of the Coronavirus Pandemic. *The New York Times*. Retrieved from https://www.nytimes.com/article/coronavirus-timeline.html
- Tenbrink, T. (2008). Space, time, and the use of language. In *Space, time, and the use of language*. De Gruyter Mouton.
- The World Bank (2021). GDP per cápita indicators. *OECD National Accounts*. Retrieved from <u>https://data.worldbank.org/indicator/NY.GDP.MKTP.CD</u>
- Thomas, J., & Barbato, M. (2020). Positive religious coping and mental health among Christians and Muslims in response to the COVID-19 pandemic. *Religions*, 11(10), 498. <u>https://doi.org/10.3390/REL11100498</u>
- Toren, C. (1988). Making the present, revealing the past: The mutability and continuity of tradition as process. *Man*, 23(4), 696-717. <u>https://doi.org/10.2307/2802600</u>
- Torralbo, A., Santiago, J., & Lupiáñez, J. (2006). Flexible conceptual projection of time onto spatial frames of reference. *Cognitive Science*, 30(4), 745-757. https://doi.org/10.1207/s15516709cog0000 67
- Traugott, E. C. (1978). On the expression of spatio-temporal relations in language. In J.
 H. Greenberg (Ed.), *Universals ofhuman language*. Word structure (Vol. 3, pp. 369–400). Stanford University Press.
- Trope, Y., & Liberman, N. (2003). Temporal construal. *Psychological review*, 110(3), 403.
- Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological review*, 117(2), 440. <u>https://doi.org/10.1037/a0018963</u>
- Tversky, B., Kugelmass, S., & Winter, A. (1991). Cross-cultural and developmental trends in graphic productions. *Cognitive Psychology*, 23, 515–557. <u>https://doi.org/10.1016/0010-0285(91)90005-9</u>

- Valenzuela, J., & Alcaraz Carrión, D. (2020). Temporal expressions in English and Spanish: influence of typology and metaphorical construal. *Frontiers in psychology*, 11, 543933. <u>https://doi.org/10.3389/fpsyg.2020.543933</u>
- Van Boven, L., & Ashworth, L. (2007). Looking forward, looking back: Anticipation is more evocative than retrospection. *Journal of Experimental Psychology: General*, 136(2), 289–300. <u>https://doi.org/10.1037/0096-3445.136.2.289</u>
- van Elk, M., van Schie, H. T., & Bekkering, H. (2010). From left to right: Processing acronyms referring to names of political parties activates spatial associations. *Quarterly Journal of Experimental Psychology*, 63(11), 2202–2219. <u>https://doi.org/10.1080/17470218.2010.495160</u>
- Varnum, M. E. W., Grossmann, I., Kitayama, S., & Nisbett, R. E. (2010). The origin of cultural differences in cognition: Evidence for the social orientation hypothesis. *Current Directions in Psychological Science*, 19(1), 9–13. <u>https://doi.org/10.1177/0963721409359301</u>
- Walker, E. J., Bergen, B. K., & Núñez, R. (2017). The spatial alignment of time: Differences in alignment of deictic and sequence time along the sagittal and lateral axes. Acta Psychologica, 175, 13–20. <u>https://doi.org/10.1016/j.actpsy.2017.02.001</u>
- Walker, E. J., Bergen, B. K., & Núñez, R. (2014). Disentangling spatial metaphors for time using non-spatial responses and auditory auditory stimuli. *Metaphor and Symbol*, 29, 316–327. https://doi.org/10.1080/10926488.2014.948801
- Wang, Q., Hou, Y., Tang, H., & Wiprovnick, A. (2011). Travelling backwards and forwards in time: Culture and gender in the episodic specificity of past and future events. *Memory*, 19(1), 103–109. <u>https://doi.org/10.1080/09658211.2010.537279</u>
- Wang, Q., & Conway, M. A. (2004). The stories we keep: Autobiograph- ical memory in American and Chinese middle-aged adults. *Journal of Personality*, 72, 911–938. <u>http://dx.doi.org/10.1111/j.0022-3506.2004 .00285.x</u>
- Wang, M., Rieger, M. O., & Hens, T. (2016). How time preferences differ: Evidence from 53 countries. *Journal of Economic Psychology*, 52, 115-135. <u>https://doi.org/10.1016/j.joep.2015.12.001</u>
- Weger, U. W., & Pratt, J. (2008). Time flies like an arrow: Space-time compatibility effects suggest the use of a mental timeline. *Psychonomic Bulletin & Review*, 15(2), 426-430. <u>https://doi.org/10.3758/PBR.15.2.426</u>

Whorf, B. L. (1956). Language, thought and reality: Selected writings. MIT Press.

- Williams, L. E., Huang, J. Y., & Bargh, J. A. (2009). The scaffolded mind: Higher mental processes are grounded in early experience of the physical world. *European Journal* of Social Psychology, 39(7), 1257–1267. <u>https://doi.org/10.1002/ejsp.665</u>
- Wirtz, D., Kruger, J., Napa Scollon, C., & Diener, E. (2003). What to do on spring break? The role of predicted on-line, and remembered experience in future choice. *Psychological Science*, 14, 520-524. <u>https://doi.org/10.1111/1467-9280.03455</u>

Wiseman, T. (2004). The Myths of Rome. University of Exeter Press.

- Wittmann, M., & Paulus, M. P. (2009). Temporal horizons in decision making. Journal of Neuroscience, Psychology, and Economics, 2(1), 1–11. <u>https://doi.org/10.1037/a0015460</u>
- Yau, O. H. (1988). Chinese cultural values: Their dimensions and marketing implications.
 European Journal of marketing, 22(5), 44-57.
 <u>https://doi.org/10.1108/EUM00000005285</u>
- Yi, R., Gatchalian, K. M., & Bickel, W. K. (2006). Discounting of past outcomes. *Experimental and Clinical Psychopharmacology*, 14(3), 311–317. <u>https://doi.org/10.1037/1064-1297.14.3.311</u>
- Yıldırım, M., Kızılgeçit, M., Seçer, İ., Karabulut, F., Angın, Y., Dağcı, A., ... & Çinici, M. (2021). Meaning in life, religious coping, and loneliness during the coronavirus health crisis in Turkey. *Journal of religion and health*, 60(4), 2371-2385. <u>https://doi.org/10.1007/s10943-020-01173-7</u>
- Yu, N. (1998). The contemporary theory of metaphor: A perspective from Chinese. John Benjamins.
- Yves Congar, O. P. (2016). The meaning of tradition. Ignatius Press.
- Yu, N. (2012). The metaphorical orientation of time in Chinese. *Journal of Pragmatics*, 44(10), 1335–1354. <u>https://doi.org/10.1016/j.pragma.2012.06.002</u>
- Zanker, P. (1988). *The Power of Images in the Age of Augustus*. University of Michigan Press.

- Zapata, O. (2018). Turning to God in Tough Times? Human versus Material Losses from Climate Disasters in Canada. *Economics of Disasters and Climate Change*, 2(3), 259–281. https://doi.org/10.1007/S41885-018-0029-2
- Zauberman, G., Kim, B. K., Malkoc, S. A., & Bettman, J. R. (2009). Discounting time and time discounting: Subjective time perception and intertemporal preferences. *Journal of Marketing Research*, 46(4), 543-556. <u>https://doi.org/10.1509/jmkr.46.4.54</u>
- Zimbardo P. G., Boyd J. N. (1999). Putting time in perspective: A valid, reliable individual-differences metric. *Journal of Personality and Social Psychology*, 77, 1271-1288.
- Zimbardo, P., & Boyd, J. (2008). *The time paradox: The new psychology of time that will change your life*. Simon and Schuster.
- Zwaan, R. A. (2004). The immersed experiencer: Toward an embodied theory of language comprehension. *Psychology of learning and motivation*, 44, 35-62.



