



Unravelling the jumping to conclusions bias in daily life and health-related decision-making scenarios

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ABSTRACT

Reasoning biases are ubiquitous and may lead to errors in daily situations. Jumping to Conclusions (JTC) is the tendency to reach decisions based on scarce data. This study examines JTC in daily life and health-related scenarios, presenting primarily positive or negative information for decision-making. Two population-based surveys containing an experimental paradigm to measure JTC were conducted in a representative sample (N = 1949) during the first month of COVID-19 confinement. JTC task presented daily and health-related scenarios, providing predominantly positive or negative decision-making information. JTC bias prevalence was significantly higher in daily life scenarios and when deciding with mostly negative information. Specifically, when mainly negative information was available, anxiety raised the JTC likelihood in health-related scenarios, while higher levels of paranoid beliefs increased JTC in daily life-related scenarios. Optimism and age increased the JTC odds in decisions where available information was predominantly positive. Findings highlight contextual and psychological characteristics influencing decision-making in health and daily life issues.

1. Introduction

Should I use my car or public transport? Is the person approaching me friendly? Should I order a dessert? Throughout the day, people make multiple decisions; however, this decision-making process can be influenced by a broad range of deviations from rational judgment, such as cognitive biases (Ehrlinger et al., 2016). One of the most studied biases is the Jumping to Conclusions bias (JTC), which occurs when decisions are hastily made using insufficient information (Dudley et al., 2016). Specifically in research, JTC is assessed with probabilistic tasks wherein a decision is made between two options, and the number of stimuli gathered before the decision is considered. The JTC bias is exhibited when the decision is reached after two or fewer stimuli.

Some studies have underscored its prevalence within the general population. For instance, Freeman et al. (2008) showed that 20 % of their sample comprising non-clinical individuals exhibited the JTC bias in the commonly used decision task known as the Beads task (Huq et al., 1988). A more recent study conducted with a community sample

utilizing the same task revealed that 51 % of their healthy individuals, devoid of affective or psychotic symptoms, displayed the JTC bias (Rauschenberg et al., 2021).

JTC may have significant consequences for individuals' daily lives. This bias can lead to erroneous choices, potentially contributing to establishing outlandish ideas as credible beliefs due to the lack of verification with complete trustworthy information (Freeman & Garety, 2014; Jolley et al., 2014). In this regard, several studies have linked the JTC bias with the establishment of delusional beliefs, in particular paranoid ideation. Previous findings have indicated that the greater the presence of JTC, the higher the severity of these beliefs (McLean et al., 2017). In this vein, it has been postulated that individuals manifesting delusional beliefs exhibit a tendency to assign excessive weight to the presented information, jumping to conclusions (Dudley et al., 1997). Moreover, once these delusions become entrenched, individuals may exhibit a heightened reliance on these core beliefs, impeding the assimilation of new information and reinforcing their convictions not examining all available evidence (Diaconescu et al., 2019).

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Moreover, the JTC bias may also be connected to the formation of other types of beliefs. Findings suggest an association between its occurrence and the endorsement of conspiracy theories, especially in contexts characterized by uncertainty (Kuhn et al., 2022; Pytlik et al., 2020; van Prooijen & Douglas, 2017). Given these findings, it seems plausible that if JTC can contribute to the development and perpetuation of delusional and conspiratorial beliefs, it may similarly play a role in shaping and reinforcing other belief systems, such as religious, political, or social ideologies. However, research on the relationship of JTC with other types of belief systems usually held with conviction, such as religious or beliefs on social group equity, is scarce. In turn, some studies have examined JTC in relation to reasoning processes as suggested by the Dual Process Model (Epstein, 1994; Kahneman, 2003). This model proposes two types of reasoning underlying decision-making: (1) heuristic thinking, dependent on the intuitive System 1 for quick decisions based on the recognition of similar past situations, and (2) reflective thinking, involving slow, analytical System 2 processing that requires conscious cognitive effort. Previous studies indicate that individuals inclined towards the heuristic reasoning style of System 1 often manifest the JTC bias, revealing a notable correlation between the two (Bronstein et al., 2019; Ross et al., 2016).

Thus, while research on JTC has predominantly focused on its association with the development of delusional beliefs and reasoning, there is growing recognition of its potential relationship with other emotional and psychological factors that may increase its presence. Some authors suggest that JTC is not a stable trait, exhibiting fluctuations due to other variables (Lüdtke et al., 2017). In this regard, a few studies have suggested that high levels of positive affect, state anxiety as also trait anxiety, and intolerance to uncertainty may trigger JTC (Bensi & Giusberti, 2007; Broome et al., 2007; Lee et al., 2011; Lincoln, Lange, et al., 2010). Yet, studies on the effect of emotional variables on JTC beyond anxiety remain limited.

Hence, considering the association of JTC with previously explored beliefs and emotional variables such as delusions and anxiety, this study delves into this bias in correlation, for the first time, with various belief systems, such as religion, positive beliefs about the future, and social equity, as well as sociodemographic factors and psychological variables. Based on previous results that report the effect of decisional scenarios, in particular indicating that salience can lead to JTC (Westermann et al., 2012), we investigated the JTC bias in two different decision-making scenarios. One concerns daily decisions, while the other involves decisions with potential health implications related to COVID-19. This allows us to determine whether decisions involving possible health-related consequences exhibit different degrees of JTC bias compared to everyday scenarios.

As part of an international consortium's protocol (McBride et al., 2020), the present study presents findings from two population-based surveys completed by the same participants. One focuses on assessing JTC in daily life and health-related scenarios characterized by predominantly negative information available for decision-making (hereafter JTCtask_{neg}). Conversely, the other evaluates JTC within the same scenarios but with predominantly positive information available for decision-making (hereafter JTCtask_{pos}).

This study aims, firstly, to determine the prevalence of the JTC bias concerning daily life and health-related scenarios, characterized by information of predominantly negative or positive valence. Secondly, to explore the predictors associated with the JTC bias within the decision-making scenarios and the predominant valence of information available for decision-making. The predictors under examination encompass variables previously associated with the JTC bias, as shown by studies using neutral tasks, including intolerance of uncertainty, paranoia, and general anxiety. Moreover, we delve into additional variables that may be linked to JTC, such as beliefs encompassing religion, positive beliefs about the future, and perceived social equity. Notably, the study was conducted during the initial month of the COVID-19 lockdown in Spain. Therefore, we include as predictors variables pertinent to the COVID-19

health crisis, such as pandemic-induced anxiety, economic threat related to COVID-19, and the sources of information consulted to gather knowledge about the pandemic.

2. Materials and methods

2.1. Participants

Our study employed a stratified quota sampling approach to recruit participants from an online research panel, ensuring a representative sample reflecting key demographic characteristics, including sex, age, household income, and regional distribution, consistent with the population of Spain. Participants volunteered for the study and received monetary compensation. To maintain data integrity, we implemented a time-limit methodology outlined by Edwards (2019). The minimum duration required to complete the comprehensive questionnaire satisfactorily was computed, establishing a threshold of no <20 min. A total of 173 participants who completed the survey in less than this stipulated time frame were subsequently excluded from the analysis. Additionally, 352 participants were also excluded due to their prior familiarity with the analytical reasoning measure. This entailed excluding individuals who indicated prior knowledge of the survey questions, mitigating potential response biases.

Consequently, our final sample for the population-based survey JTCtask_{neg} comprised 1597 participants. Subsequently, following a one-month interval per the original international consortium's protocol timeline (McBride et al., 2020), these participants were invited to participate in the population-based survey JTCtask_{pos}. Of the invited participants, 1370 completed the second survey, and after discarding 44 based on the same time-limit criteria, a final sample of 1326 was included in the analysis, representing a modest attrition rate of 17 %.

2.2. Measures

2.2.1. Criterion variable: JTC

The JTC bias was assessed by adapting the Real-Life paradigm (Peinado et al., 2024, in press), which has shown excellent construct validity. Administered online via Qualtrics (<https://www.qualtrics.com>), the task featured original and newly developed scenarios focusing on COVID-19 situations. Specifically, it consisted of four scenarios presented randomly to all participants. Two simulated decision-making in everyday life and two focused on health-related decisions and COVID-19 (see Table 1). The task began with an initial screen presenting a description of the scenario, a piece of relevant information, and a question about it. Participants could respond by selecting one of two available options or requesting additional information, limited to a maximum of 10. Following each new piece of information, participants could respond or request further information. The sequence of pieces of information was predetermined before the study commenced. In the JTCtask_{neg} the information proportion was 7:3 negative to positive, whereas in the JTCtask_{pos} this ratio was the inverse.

The mean number of pieces of information (hereafter PoI) requested to decide in each type of scenario (Daily life / Health-related) was calculated. The presence of the JTC bias was operationalized following established criteria (Garety et al., 2005), where a mean number of pieces of information ≤ 2 was indicative of JTC bias (coded as 1), and a mean of ≥ 3 indicated the absence of JTC bias (coded as 0). This criterion was applied to determine the presence or absence of the JTC bias in each of the four conditions: daily-life scenario JTCtask_{neg}, daily-life scenario JTCtask_{pos}, health-related scenario JTCtask_{neg} and health-related scenario JTCtask_{pos}.

2.2.2. Predictor variables

Sociodemographic information. In addition to *age* in years, we asked participants about their *educational level* (0 = Mandatory; 1 = High school; 2 = Technical training; 3 = University; 4 = Postgraduate); their

Table 1
Characteristics of the scenarios in JTC-RL.

| | Scenarios | | | |
|-------------------------|---|---|--|---|
| | Shopping ¹ | Flats ² | Street ³ | Shopping ⁴ |
| Type of decision | Daily life | Daily life | Health-related | Health-related |
| Question | Do you buy the product from this seller (option 1) or not (option 2)? | Do you think it is a community of friendly (option 1) or problematic neighbours (option 2)? | Do you think this person is probably infected with COVID-19 (option 1) or probably not (option 2)? | Do you buy the food when you had planned (option 1) or today (option 2)? |
| Example of negative PoI | "It arrived broken" | "There is a neighbour who steals other people's letters" | "The person tells someone on the phone he/she hopes not to get worse" | "TV news announce the first looting in supermarkets in another country" |
| Example of positive PoI | "Great, it came with another charger as a gift" | "Neighbours are generally polite at meetings" | "The person looks to see if any car is coming" | "TV news report that food transporters are continuing their routes as normal" |
| Options | Seller A/No Seller A/Another PoI | Friendly/Problematic/Another PoI | Infected/Non-infected/Another PoI | As planned/Today/Another PoI |
| Sequence | AAAABBAAB | AABAAAABBA | AABAAAABBA | AAAABBAAB |

Note: Text describing the scenario: 1 = You are looking at an online shop, and two sellers have what you need for the same price. You read the reviews of other buyers about one of the sellers. Below are some of those reviews; 2 = You will move to a new flat in a building. You have seen two similar flats you like, so you visit one of the buildings. You will then see some information that the janitor gives you about this community of neighbours; 3 = Recently, during these days of a state of alarm, you are walking down the street and, when waiting to cross at a pedestrian traffic light, a person wearing a face mask arrives and stands next to you. You will then see information about this person; 4 = Recently, during these days of state of alarm, you are watching TV while thinking that you will go grocery shopping within a couple of days because you still have some food left. You then see some news on TV. PoI = piece of information.

annual income in euros (0 = Up to 20,200; 1 = 20,200–35,200; 2 = 35,200–60,000; 3 = Over 60,000); and religious beliefs (0 = No; 1 = Yes).

Pandemic-related variables: Two single items on anxiety related to COVID-19 and economic threat due to the COVID-19 context were collected on visual scales from 0 (Not at all) to 100 (Very much) and 0 (Not at all) to 10 (Very much), respectively. Participants also rated from 1 (Not at all) to 4 (Very much) how much information they gathered from several sources of information, categorized as traditional (newspapers, TV, or radio), social (internet, social media, or friends), and official (doctors, other health care professionals, or government agencies).

Conspiracy Mentality Questionnaire Short Form (SF-CMQ; Bruder et al., 2013). It is a 5-item instrument that measures general conspiracy mentality. Participants indicated to what extent they agreed with the items (e.g., *There are secret organizations that have a significant influence on political decisions*) on a scale from 0 % (Certainly not) to 100 % (Certainly). A total score was obtained by averaging all item scores. The reliability was excellent ($\alpha = 0.84$).

Social dominance Orientation (SDO7; Ho et al., 2015). This 8-item scale measures intergroup attitudes and behaviours supporting social group inequality (e.g., *An ideal society requires some groups to be on top and others to be on the bottom*). Participants responded using a Likert-type format ranging from 1 (Strongly disagree) to 5 (Strongly agree). A total score was obtained by averaging all items. Higher scores indicate being more in favour of the dominance of some groups over others. The reliability was good ($\alpha = 0.78$).

Intolerance to Uncertainty Scale (IUS; Buhr & Dugas, 2002). It is a 12-item instrument assessing intolerance to uncertainty (e.g., *The slightest doubt can prevent me from acting*). Participants indicate to what extent each characteristic aligns with their own traits using a 5-point Likert scale from 1 (Not at all characteristics of me) to 5 (Entirely characteristic of me). A total score is calculated by summing up all the items. The higher the score, the more intolerance to uncertainty. The reliability of this study was excellent ($\alpha = 0.87$).

Generalized Anxiety Disorder (GAD-7; Spitzer et al., 2006). It is a 7-item scale measuring symptoms of generalized anxiety disorder over the last two weeks (e.g., *Has not been able to stop worrying*). Participants rated the frequency on a 4-point Likert scale from 0 (None of the days) to 3 (Almost every day). The total score was obtained by adding the scores of all items. The reliability of this study was excellent ($\alpha = 0.93$).

The short-form Persecution and Deservedness Scale (SF-PaDS; McIntyre et al., 2018). Translated version Valiente et al., 2021) is a 5-item instrument that measures paranoid ideation (e.g., *I am often*

suspicious of others' intentions towards me). Participants indicated their degree of agreement on a scale from 1 (Strongly disagree) to 5 (Strongly agree). A total score was obtained by adding up all the items. The reliability of this study was good ($\alpha = 0.84$).

Cognitive Reflection Test (CRT; Frederick, 2005). It measures heuristic/analytical reasoning. It consists of three problems that trigger an intuitive heuristic response (from System 1), which must be inhibited by more reflective reasoning (from System 2) to arrive at the correct answer. For example, when faced with the item "*A bat and a ball cost 1.10 euros in total. The bat costs 1 euro more than the ball. How much does the ball cost?*", responders might choose an intuitive response related to heuristic thinking (i.e., *10 cents*), the correct answer requiring analytic reasoning (i.e., *5 cents*), or two other answers (i.e., *9 cents* and *1 cent*). More correct answers indicate an analytical reasoning style, contrasting with heuristic reasoning. An item was added for participants to indicate whether they previously knew these problems, so those who answered yes were removed from the analysis ($N = 352$). The Cronbach's alpha was good ($\alpha = 0.72$).

Openness to the Future Scale (OF; Botella et al., 2018). This 10-item scale assesses positive views of the future (e.g., *I tend to trust that things will turn out well*). Participants indicated their agreement with the items in a 5-point Likert scale from 1 (Strongly disagree) to 5 (Strongly agree). A total score was obtained by adding all the item scores. The Cronbach's alpha in this study was good ($\alpha = 0.80$).

2.3. Procedure

All potential participants from the panel were provided with detailed information about the study and had the opportunity to seek clarification from a designated team member. Those who voluntarily opted to participate were required to provide written consent before accessing and completing the survey online. To effectively manage survey length and minimize potential participant burden, we adhered to recommendations aimed at reducing cognitive load and preventing survey abandonment (Galesic & Bosnjak, 2009). Consequently, the JTC assessment was conducted across two surveys, leveraging the established international protocol carried out by our research group.

The first survey, conducted from April 7th to 14th, 2020, comprised the sociodemographic and pandemic-related variables, the psychological questionnaires, the CRT, and the JTCtask_{neg}. The second survey, containing pandemic-related items, psychological questionnaires, and the JTCtask_{pos} was conducted from May 7th to 14th 2020. At the time

our first survey was launched on April 7th, 2020, the global COVID-19 pandemic affected heavily Spain, where 14,792 deaths were reported, second only to Italy. In response, the Spanish government declared a state of emergency on March 14th, 2020, imposing a seven-week nationwide lockdown, in line with World Health Organization (WHO) recommendations. Citizens were restricted to their homes except for essential activities like work for healthcare professionals and grocery shopping, with strict adherence observed (Google's COVID-19 Community Mobility Reports, 2020). Notably, during the second survey, individuals remained confined to their homes.

2.4. Data analysis

All data were analyzed using SPSS v.24 (IBM Corp, 2016). We calculated the presence of JTC bias in the daily life, and the health-related scenarios within the JTCTask_{neg} and the JTCTask_{pos}. Then, for the JTCTask_{neg} participants were categorized into four groups coded as:

- 0 = 'No JTC' (no bias in either daily life or health-related scenarios),
- 1 = 'Health-related JTC' (bias only in health-related scenarios),
- 2 = 'Daily life JTC' (bias only in daily life scenarios),
- 3 = 'Dual JTC' (bias in both daily life and health-related scenarios).

The same categorization was applied to the JTCTask_{pos} data. Subsequently, we calculated the prevalence of JTC bias and reported frequencies for each group. Finally, we conducted separate multinomial logistic regression analyses using the JTCTask_{neg} and JTCTask_{pos} datasets to identify sociodemographic and psychological variables predicting membership in the four JTC bias groups. The statistical significance was established at $p < .05$.

3. Results

Descriptive statistics of the sample used for the analyses in both surveys are depicted in Table 2.

Prevalence findings for JTCTask_{neg} and JTCTask_{pos} are presented in

Table 2
Sample sociodemographic characteristics.

| | JTCTask _{neg} N = 1597 | JTCTask _{pos} N = 1326 |
|--|------------------------------------|------------------------------------|
| Sex: female, n (%) | 780 (48.8) | 645 (48.6) |
| Age, mean (SD, range) | 45.8 (12.6; 18–75) | 46.4 (12.6; 18–75) |
| Educational level, n (%) | | |
| Mandatory | 209 (13.1) | 176 (13.3) |
| High school | 362 (22.7) | 298 (22.5) |
| Technical training | 245 (15.3) | 195 (14.7) |
| University | 598 (37.4) | 507 (38.2) |
| Postgrad | 183 (11.5) | 150 (11.3) |
| Religious beliefs: yes, n (%) | 961 (60.2) | 806 (60.8) |
| Urbanicity of residential location, n (%) | | |
| Rural | 250 (15.7) | 199 (15) |
| City | 1347 (84.3) | 1127 (85) |
| Current activity: yes, n (%) | 1157 (72.4) | 944 (71.2) |
| Gross annual household income in euros, 2019, n (%) | | |
| Up to 20,200 | 556 (34.8) | 453 (34.2) |
| 20,200–35,200 | 564 (35.3) | 464 (35) |
| 35,200–60,000 | 374 (23.4) | 319 (24) |
| Over 60,000 | 103 (6.4) | 90 (6.8) |
| Mental health treatment, n (%) | | |
| Never | 1265 (79.2) | 1044 (78.7) |
| Currently/in the past | 307 (19.2) | 262 (19.8) |
| Rather not say | 25 (1.6) | 20 (1.5) |
| Anxiety related to COVID-19 mean (SD, range) | 58.9 (26.5; 0–100) | 59.6 (26.4; 0–100) |
| Economic threat related to COVID-19 mean (SD, range) | 6.68 (2.6; 1–10) | 6.67 (2.6; 1–10) |

Note. SD = standard deviation.

Table 3
Prevalence of JTC bias groups: n (%).

| | JTC daily life | JTC health-related | Dual JTC | No JTC |
|------------------------|----------------|--------------------|-------------|------------|
| JTCTask _{neg} | 234 (14.7) | 156 (9.8) | 1012 (63.3) | 195 (12.2) |
| JTCTask _{pos} | 184 (13.9) | 152 (11.5) | 807 (60.8) | 183 (13.8) |

Note. Prevalence of JTC bias in daily life and health-related scenarios, distinguished by predominantly negative or positive information.

Table 3. Notably, the daily life scenarios exhibited a higher prevalence of JTC bias compared to health-related scenarios. However, a notable prevalence of individuals displaying JTC bias in both tasks was observed.

3.1. Predictors of the JTCTask_{neg}

The multinomial logistic regression analysis identified religious beliefs ($\chi^2(3) = 11.148; p = .01$), paranoid beliefs ($\chi^2(3) = 16.208; p = .00$), social dominance ($\chi^2(3) = 8.831; p = .03$), general anxiety ($\chi^2(3) = 8.392; p = .04$), and the cognitive reflection style ($\chi^2(3) = 13.388; p = .00$) as significant predictors. The full model significantly improved the data fit compared to the null model ($\chi^2(48) = 89.792; p = .00$; Nagelkerke = 0.062). A satisfactory goodness of fit was indicated by Pearson ($\chi^2(4740) = 4790.605; p = .30$), and the Deviance ($\chi^2(4740) = 3278.221; p = 1$).

Results on predictors of JTCTask_{neg} for each of the four groups are depicted in Table 4. When predominantly negative information was presented, individuals with higher levels of paranoid ideation were more likely to exhibit JTC bias in daily life scenarios compared to those displaying the bias in health-related scenarios. Additionally, the latter group demonstrated higher levels of anxiety than individuals exhibiting JTC bias in daily scenarios.

Furthermore, a comparison between individuals with no JTC bias and those with JTC bias in health-related scenarios revealed that the latter group had a higher probability of engaging more in heuristic reasoning, while those with JTC bias in daily scenarios had a higher probability of gathering more information from traditional sources such as newspapers, television, and radio.

Lastly, individuals consistently exhibiting the bias in both scenarios had a higher probability of experiencing higher levels of paranoid ideation, engaging more in heuristic reasoning, and gathering more information from traditional sources.

3.2. Predictors of the JTCTask_{pos}

The multinomial logistic regression analysis showed as significant predictors age ($\chi^2(3) = 17.986; p = .00$), social media ($\chi^2(3) = 8.410; p = .04$), the cognitive reflection style ($\chi^2(3) = 10.285; p = .02$) and openness to the future ($\chi^2(3) = 12.591; p = .01$). The full model significantly improved data fit over the null model ($\chi^2(48) = 98.170; p = .00$; Nagelkerke = 0.08). A satisfactory goodness of fit was indicated by Pearson ($\chi^2(3927) = 3971.587; p = .31$), and the Deviance ($\chi^2(3927) = 2813.451; p = 1$).

The detailed predictors of JTCTask_{pos} for each group are depicted in Table 5. In general, when predominantly positive information was available for decision-making, younger individuals had a higher probability of exhibiting no JTC bias. Comparing individuals with JTC bias in daily life scenarios to those with bias in health-related scenarios, the latter had a higher probability of engaging in analytical reasoning and consulting social media. Conversely, individuals with JTC bias in daily life scenarios were more likely to perceive a greater economic threat, engage in more heuristic reasoning, and display less optimism than those with no JTC.

Lastly, comparing those consistently exhibiting JTC bias in both scenarios, individuals without JTC bias had a higher probability of being younger, engaging more in analytical reasoning, holding a less

Table 4
Logistic regression results predicting JTC bias in survey 1 (JTCtask_{neg}, with mostly negative information).

| | Dual JTC vs. No JTC | | Dual JTC vs. Health JTC | | Dual JTC vs. Daily life JTC | | No JTC vs. Health JTC | | No JTC vs. Daily life JTC | | Daily life vs. Health JTC | |
|-----------------------------------|---------------------|-------------|-------------------------|-------------|-----------------------------|-------------|-----------------------|-------------|---------------------------|-------------|---------------------------|-------------|
| | Estimate | SE | Estimate | SE | Estimate | SE | Estimate | SE | Estimate | SE | Estimate | SE |
| Sociodemographic data | | | | | | | | | | | | |
| Age | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Educational level | 0.04 | 0.07 | 0.01 | 0.07 | 0.10 | 0.06 | 0.04 | 0.09 | 0.06 | 0.09 | -0.02 | 0.09 |
| Income | -0.07 | 0.010 | -0.08 | 0.11 | -0.09 | 0.09 | -0.01 | 0.13 | -0.02 | 0.12 | 0.01 | 0.13 |
| Religious beliefs | -0.26 | 0.17 | -0.33 | 0.19 | -0.46** | 0.15 | -0.08 | 0.23 | -0.21 | 0.21 | 0.13 | 0.22 |
| Pandemic related variables | | | | | | | | | | | | |
| Anxiety related to COVID | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | -0.01 | 0.00 | 0.00 | 0.00 | -0.01 | 0.01 |
| Economic threat | -0.04 | 0.03 | -0.02 | 0.04 | -0.04 | 0.03 | 0.02 | 0.04 | 0.00 | 0.04 | 0.02 | 0.04 |
| Traditional information sources | -0.30* | 0.12 | -0.18 | 0.13 | 0.03 | 0.12 | 0.13 | 0.17 | 0.33* | 0.15 | -0.20 | 0.16 |
| Social media sources | 0.12 | 0.13 | 0.12 | 0.14 | -0.13 | 0.12 | 0.00 | 0.17 | -0.24 | 0.16 | 0.24 | 0.17 |
| Official sources | 0.07 | 0.11 | -0.03 | 0.12 | 0.00 | 0.10 | -0.10 | 0.15 | -0.07 | 0.14 | -0.03 | 0.15 |
| Psychological variables | | | | | | | | | | | | |
| Conspiracy mentality | 0.02 | 0.05 | 0.00 | 0.05 | 0.00 | 0.04 | -0.02 | 0.06 | -0.01 | 0.06 | -0.01 | 0.06 |
| Intolerance to uncertainty | -0.02 | 0.01 | -0.02 | 0.01 | -0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | -0.01 | 0.01 |
| General anxiety | 0.01 | 0.02 | 0.06** | 0.02 | 0.00 | 0.02 | 0.05 | 0.03 | -0.02 | 0.03 | 0.07* | 0.03 |
| Paranoid beliefs | -0.06** | 0.02 | -0.08** | 0.02 | -0.02 | 0.02 | -0.02 | 0.03 | 0.05 | 0.03 | -0.07* | 0.03 |
| Social dominance | 0.05 | 0.010 | 0.14 | 0.11 | 0.27** | 0.10 | 0.09 | 0.14 | 0.23 | 0.13 | -0.14 | 0.14 |
| Cognitive reflection test | 0.26** | 0.08 | -0.05 | 0.09 | 0.11 | 0.07 | -0.31** | 0.11 | -0.14 | 0.09 | -0.17 | 0.11 |
| Openness to future | -0.02 | 0.02 | -0.02 | 0.02 | -0.03* | 0.01 | 0.00 | 0.02 | -0.01 | 0.02 | 0.01 | 0.02 |

* $p < .05$.
** $p < .01$.

Table 5
Logistic regression results predicting JTC bias in survey 2 (JTCtask_{pos} with mostly positive information).

| | Dual JTC vs. No JTC | | Dual JTC vs. Health JTC | | Dual JTC vs. Daily life JTC | | No JTC vs. Health JTC | | No JTC vs Daily life JTC | | Daily life JTC vs. Health JTC | |
|-----------------------------------|---------------------|-------------|-------------------------|-------------|-----------------------------|-------------|-----------------------|------|--------------------------|-------------|-------------------------------|-------------|
| | Estimate | SE | Estimate | SE | Estimate | SE | Estimate | SE | Estimate | SE | Estimate | SE |
| Sociodemographic data | | | | | | | | | | | | |
| Age | -0.02** | 0.01 | -0.03** | 0.01 | -0.02** | 0.01 | -0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 |
| Educational level | 0.14 | 0.07 | 0.02 | 0.08 | -0.04 | 0.07 | -0.12 | 0.10 | -0.17 | 0.09 | 0.05 | 0.10 |
| Income | 0.06 | 0.10 | 0.10 | 0.11 | 0.17 | 0.10 | 0.04 | 0.13 | 0.12 | 0.13 | -0.07 | 0.13 |
| Religious beliefs | -0.29 | 0.17 | -0.19 | 0.19 | -0.09 | 0.18 | 0.10 | 0.23 | 0.19 | 0.22 | -0.09 | 0.23 |
| Pandemic related variables | | | | | | | | | | | | |
| Anxiety related to Covid | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 |
| Economic threat | -0.07* | 0.04 | -0.02 | 0.04 | 0.03 | 0.03 | 0.06 | 0.05 | 0.11* | 0.05 | -0.05 | 0.05 |
| Traditional sources | -0.06 | 0.13 | -0.20 | 0.14 | 0.03 | 0.13 | -0.14 | 0.17 | 0.09 | 0.16 | -0.23 | 0.17 |
| Social media sources | 0.02 | 0.13 | 0.21 | 0.15 | -0.28* | 0.13 | 0.19 | 0.18 | -0.30 | 0.17 | 0.50** | 0.18 |
| Official sources | -0.09 | 0.12 | -0.15 | 0.13 | 0.02 | 0.12 | -0.06 | 0.16 | 0.11 | 0.15 | -0.17 | 0.16 |
| Psychological variables | | | | | | | | | | | | |
| Conspiracy mentality | -0.05 | 0.05 | -0.02 | 0.05 | -0.03 | 0.05 | 0.03 | 0.06 | 0.01 | 0.06 | 0.01 | 0.06 |
| Intolerance to uncertainty | -0.02 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 | 0.01 | -0.01 | 0.01 |
| General anxiety | 0.00 | 0.02 | -0.03 | 0.02 | -0.02 | 0.02 | -0.03 | 0.03 | -0.02 | 0.03 | -0.01 | 0.03 |
| Paranoid beliefs | -0.02 | 0.02 | 0.00 | 0.02 | 0.01 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | -0.01 | 0.03 |
| Social dominance | 0.05 | 0.11 | -0.08 | 0.12 | 0.10 | 0.11 | -0.14 | 0.14 | 0.05 | 0.14 | -0.18 | 0.15 |
| Cognitive reflection test | 0.16* | 0.08 | 0.20* | 0.09 | -0.09 | 0.09 | 0.04 | 0.10 | -0.25* | 0.11 | 0.29* | 0.11 |
| Openness to future | -0.05** | 0.02 | -0.04* | 0.02 | -0.01 | 0.02 | 0.01 | 0.02 | 0.04* | 0.02 | -0.03 | 0.02 |

* $p < .05$.
** $p < .01$.

optimistic view of the future, and perceiving a lower economic threat.

4. Discussion

The present study used two population-based surveys to examine the prevalence and potential predictors of JTC bias in different real-life scenarios. Additionally, we explored whether the valence of the information provided (i.e., predominantly positive or negative) might affect the presence of the JTC bias.

Findings on the prevalence of these biases showed a higher

percentage of people exhibiting JTC when faced with negative rather than positive information, which aligns with previous results (Peinado et al., 2024, in press). Moreover, the proportion was slightly higher in daily life than in health-related scenarios, suggesting that less routine decisions that may have more severe consequences, such as those related to health, lead to more information gathering. Studying bias across different scenarios allows examining how individuals adapt their decision-making to the situation, enabling research to distinguish which individuals are biased in all scenarios, even those with more severe consequences, and thus systematically exhibit the JTC bias.

The results of both tasks (JTCtask_{neg} and JTCtask_{pos}) indicated a high percentage of individuals (63.3 % and 60.8 %) with a consistent pattern of JTC bias in all scenarios (Dual JTC). These high numbers align with recent results provided in a longitudinal study where groups of individuals with the presence or absence of psychotic and affective symptoms performed the Bead task, showing prevalence in these groups between 30 and 88.9 % (Rauschenberg et al., 2021). Our findings may be related to the use of social and salient content that may have increased the presence of the JTC bias (e.g., Westermann et al., 2012). Several authors have highlighted the relevance of studying the JTC within naturalistic scenarios (Moritz et al., 2022), which may reflect a more accurate measure of the amount of information that people gather in decision-making outside the laboratory. However, it does raise questions about the threshold at which research and clinicians consider JTC bias to be present, and future studies may consider this cut-off in relation to the topic decided and the information available.

Different predictors were found according to the prevailing valence of the information available to decide on the JTC tasks. When the information was mainly negative, the JTCtask_{neg} revealed that general anxiety, paranoid ideation, supporting social group inequality, religion, and analytical reasoning were significant predictors of the bias. When information was predominantly positive, the JTCtask_{pos} was predicted by age, use of social media, analytical reasoning, and openness to the future. Among all these variables, reasoning style was the only predictor common to both tasks, with individuals with an analytical reasoning style being more likely to show no JTC bias, while those with a more heuristic thinking style were more likely to exhibit dual JTC. Therefore, the analytical reasoning style could be considered a protective factor against JTC bias. While this result aligns with previous research (Ross et al., 2016) that used neutral decision tasks, our study extends this finding to more naturalistic decision-making scenarios. These results suggest that changes in reasoning style could be a target to reduce JTC bias in all types of decision scenarios.

Regarding specific predictors of the JTC bias groups: JTC only in daily life scenarios, JTC only in health-related scenarios, dual JTC and no JTC bias, in the face of predominantly negative information, individuals who exhibited a JTC bias in health-related decisions were those with higher levels of general anxiety, adding further evidence to previous findings where anxiety leads to more intuitive decisions where less information is considered (Marques da Rocha et al., 2023). Similarly, a previous study found that the JTC bias is increased when decision-making is made in a threatening or social-evaluative context compared with neutral scenarios (Schlier et al., 2016). According to Dudley and Over (2003), in perceived anxious or threatening situations, individuals may accept the information that confirms their pre-existing beliefs about the threat, failing to consider alternative explanations through the JTC bias. In this line, our results may highlight the relevance of the decision-making situation in examining this JTC-anxiety relationship. Prior research has found that the health crisis has increased anxiety levels in the general population (Albagmi et al., 2022). Thus, the alarming context may have strengthened the connection between anxiety and JTC biases on health-related topics. Future studies may test the role of anxiety in the JTC bias in different decision-making scenarios and investigate the mechanisms underlying this association.

Furthermore, those who jump to conclusions in health-related scenarios reported significantly lower levels of paranoia than those displaying JTC exclusively in daily life scenarios and those with a consistent pattern of JTC. Our findings, consistent with previous research demonstrating a significant association between JTC and paranoia (Ross et al., 2015), specifically highlight the scenarios where this relationship is more pronounced. Everyday life scenarios, which better reflect the subjects' reality, may contribute to a higher prevalence of JTC, as these situations involve social interactions where paranoid ideation may be more readily triggered (Raihani & Bell, 2017).

An additional relevant aspect of our results is that, in the presence of predominantly positive information, regardless of the type of scenario,

older individuals present more JTC bias than younger individuals. This result was not found in the JTC-RL⁻ task, and future studies could examine the impact of information valence on the association between JTC and age. Interestingly, when positive information was available to decide, optimism (measured with the openness to future scale) increased the likelihood of exhibiting JTC in both scenarios (Dual JTC) compared to individuals with no JTC. Optimism entails positive a priori beliefs about the future, which, according to the Bayesian statistical theory, may be updated and adapted to the individual's experience with new information. Some evidence suggests that optimistic individuals may show a bias whereby they do not update their optimistic prior beliefs due to selective updating failures in which they downcode undesirable future-related information, maintaining their optimistic beliefs (Sharot, 2011). According to recent results, when searching for information to make a decision, optimistic individuals who are a priori confident in an option compatible with their beliefs tend to bias the search for new information by sampling evidence that matches their beliefs, something that is not possible when information is acquired by fixed sampling (Kaanders et al., 2022). Our results may suggest that optimism, like any a priori belief, could be maintained in fixed sampling through the JTC bias, whereby obtaining information compatible with beliefs would stop gathering more information. To our knowledge, this is the first study examining JTC bias with optimism, religion, and social dominance orientation, considering the valence of information for making a decision. Similar to optimism, other core beliefs of individuals, such as religious beliefs or ideas about social dominance orientation, could be maintained through cognitive biases like JTC or confirmatory bias. Therefore, future replications of these results will be important and may confirm the relationship of JTC bias to these variables.

Finally, intolerance to uncertainty was not associated with JTC bias, aligning with previous findings from clinical samples (Dudley et al., 2011) and from a large general population sample (Kabengele et al., 2023). Regarding conspiracy mentality, our results did not support a significant relationship with JTC bias. This suggests, in line with previous findings, that JTC bias may be more closely related to specific conspiracy theories rather than a general propensity towards believing in conspiracies (Kabengele et al., 2023). Along these lines, future research could investigate whether the association between JTC and conspiracy theories resembles the observed relationship between JTC and paranoid beliefs, given that these represent distinct types of beliefs, with different predictor variables, although all are essential and highly relevant to the individual (Martinez et al., 2022).

This study has the following limitations. Firstly, as the psychological measures were self-reported, so a social desirability bias may have occurred, although the reliability of the questionnaires was high. Secondly, the positive or negative value of the information may have been interpreted by participants in different ways; nevertheless, our results aligned with previous findings on the relation between JTC and the effect of information valence. Thirdly, the study was conducted amidst a global crisis, the COVID-19 pandemic, characterized by distinct socio-economic circumstances and implications that could have impacted the results, potentially leading to an underestimation of the effects of other variables. While the conditions during the study were exceptional within the population, similar situations were prevalent in other countries. Therefore, further research in this area is recommended to better grasp the implications of this limitation. Conducting similar studies in various nations during comparable situations could enhance our understanding of decision-making in extreme emergency scenarios, transcending cultural disparities. This, in turn, could shed light on other contexts, such as ongoing climate change or potential future pandemics. For example, numerous studies conducted across different countries have demonstrated similar outcomes regarding the psychological effects of the pandemic (Shevlin et al., 2022). The implications of biased decision-making during health crises are especially noteworthy. In the case of COVID-19, such biases have been associated with vaccine hesitancy (Murphy et al., 2021) and disregard for safety measures (Kantorowicz-

Reznichenko et al., 2022). Finally, access to the questionnaires via an internet link facilitated the assessment of a large sample, although it might not have reached individuals without internet access.

The study also has some remarkable strengths. Previous studies have underscored the limitations of the traditional neutral task in measuring the JTC bias, such as issues with abstractness, engagement, and comprehension that may influence results. Our study employed a validated measure, the RLP, which exhibited greater engagement, understanding, and alignment with real-life decision-making processes (Peinado et al., 2024, in press). Moreover, unlike most previous studies, in which JTC bias is measured with experimental tasks in a laboratory, this study has measured the bias through a population-based survey adapting the experiment to this format, what allows the generalization of the laboratory-based results in a representative sample (Mutz, 2011). Adapting experimental paradigms into population-based survey may have certain advantages over laboratory experiments (Morton & Williams, 2010), with a potentially high degree of external validity while maintaining reasonable control over the experimental conditions (Sanz-Menéndez & Cruz-Castro, 2019). In our case, an additional strength is that we conducted the study on a large sample with national representativeness. The measures included variables like anxiety, paranoia, and optimism that shed some light on relevant aspects associated with JTC biases knowledge.

In summary, the findings support recent results indicating the effect of different scenarios and the valence of the information available on JTC biases. Specifically, anxiety may be critical to JTC bias in health decisions, whereas paranoia may relate more to JTC bias in daily life. In addition, analytical reasoning could be considered a protective factor against JTC bias in any scenario, which may provide some cues to design future interventions to prevent or modify JTC biases. Our study significantly contributes to identifying both contextual and psychological factors that trigger the JTC bias. Knowing more about these variables is essential in preventing the consequences of cognitive biases, like the JTC, on people's functioning and well-being, as well as on their behaviours during global crises.

Compliance with ethical standards statement

All procedures performed follow the ethical standards of the (hidden for review) research committee, the 1964 Helsinki Declaration, and its later amendments or comparable ethical standards.

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CRediT authorship contribution statement

Vanesa Peinado: Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Carmen Valiente:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization. **Alba Contreras:** Writing – review & editing, Methodology, Investigation. **Almudena Trucharte:** Writing – review & editing, Methodology, Investigation. **Carmelo Vázquez:** Writing – review & editing, Supervision, Resources, Funding acquisition.

Declaration of competing interest

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Data availability

Data will be made available on request.

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