

University of Belgrade

Faculty of Philosophy

Marija B. Petrović

**CONSISTENTLY INCONSISTENT:
PREDICTIVITY AND VALIDITY OF
DOUBLETHINK**

Doctoral dissertation

Belgrade, 2025

Univerzitet u Beogradu

Filozofski fakultet

Marija B. Petrović

DOSLEDNO NEDOSLEDNI: PRIRODA I
PREDIKTIVNOST KONSTRUKTA DUPLOG
MIŠLJENJA

Doktorska disertacija

Beograd, 2025

Supervisor:

Full Professor Iris Žeželj, PhD

University of Belgrade, Faculty of Philosophy, Department of Psychology

Board members:

Full Professor Goran Knežević, PhD

University of Belgrade, Faculty of Philosophy, Department of Psychology

Associate Professor Kaja Damjanović, PhD

University of Belgrade, Faculty of Philosophy, Department of Psychology

Associate Professor Predrag Teovanović, PhD

University of Belgrade, Faculty for Special Education and Rehabilitation

Date:

Zahvalnica (Acknowledgments)

Pisanje zahvalnice mi je najavljeno kao jedan od lepih i zaokružujućih trenutaka pisanja disertacije, te je *prirodno* nešto što sam izbegavala. To je i zato što zahteva izvesnu dozu ozbiljnosti i ranjivosti što mi je naravno *potpuno* strano, te ću se u duhu ove disertacije truditi da to ostvarim dok, istovremeno, to maksimalno izbegavam. Prirodno, ja ništa u životu nisam sposobna sama, i izrada ove disertacije je zahtevala beskrajnu podršku i beskrajno strpljenje od strane mnogih ljudi koji su imali tu nesreću da se uključe u moj život na ovaj ili na onaj način.

Pre svega hvala mojoj mentorki Iris Žeželj doslovno na svemu ikada - hvala joj na nesebičnom i neizmernom prenošenju znanja i na tome što sam imala priliku da tokom svih ovih godina učim od nje o tome kako se kvalitetno i pošteno "radi" nauka. Hvala joj što me je podržavala na svakom koraku, čak i kada sam se tome znantno opirala. Hvala joj što konstantno nesebično (i preko svake mere i očekivanih normi) daje svoje vreme i ekspertizu, ne samo meni, nego svim ljudima sa kojima radi (ali meni posebno jer sam ja ovde najbitnija, a i treba dosta vremena uložiti da bi se obezbedio prosečan kvalitet mog rada). Kad smo kod toga, hvala joj na neizmernom strpljenju koje je potrebno da bi se sa mnom radilo, što zbog pomenutog vremena i truda koje treba uložiti, što zbog raznih pošalica koje treba istrpeti - posebno joj hvala što je trpela najdužu od njih o tome da ću se ispisati sa doktorata (a koju ću izvesno koristiti do poslednjeg momenta). I hvala joj što je uspevala da izvuče smisao iz misli i rečenica koje kad počnem ne znam kako će da se završe. Tokom doktorskih studija, upoznala sam mnoge kolege, što ovde, što u inostranstvu, i na osnovu moje izuzetno detaljne analize, mogu samo da zaključim da niko nije imao takvu mentorsku podršku i negovanje kao ja (a ja sam zaista uvek u pravu), i hvala joj i na tome. I hvala joj na svemu što je radila za mene i delila sa mnom i van samog doktorata. A Iris Žeželj pre svega hvala na Jaslicama.

Hvala Milici Ninković, dr - ja doista teško stičem i zadržavam prijatelje i beskrajno sam joj zahvalna što je bila moja prijateljica tokom izrade ove disertacije (a izvesno će morati i posle). Hvala joj na tome što se bez ikakvog dogovora (šta god ljudi mislili) uvek slažemo oko praktično svih pitanja (osim toga da li su ljudi i svet grozni ili pak mogu da se iskupe) i što je drugarica (komunistički). Hvala joj na prostoru da budemo zle zajedno (a u stvari samo u pravu), hvala joj što je uvek na pravoj strani istorije, hvala joj što je praktično jedini saradnik za kojeg nemam nikakve zamerke i što zajedno radimo i radićemo na važnim projektima koje smišljamo u kafani. Hvala joj i na jedinom projektu za koji sam naglas izgovorila da sam ponosna na njega. A pre svega joj hvala što je uvek, bez greške, bila autentično srećna zbog svakog mog, čak i minimalnog, postignuća i posebno u trenucima kada ja nisam imala kapaciteta da se radujem za sebe (što je skoro uvek).

Hvala i Petru što ne samo da je tolerisao razne budalaštine koje sam razvila kao coping mehanizme u toku ovog doktorata, nego što se u njih aktivno uključivao. Hvala mu i na strpljenju i slušanju beskonačnog toka misli koji izlazi iz mene i što je razvio veliku osetljivost za (manje ili više) suptilne promene raspoloženja kojima sam bila sklona u toku izrade ove disertacije, i što se uvek trudi da me iščupa iz onih negativnih. Hvala mu i za *mnoge* trinkete i za to što (meni) deluje da se družimo mnogo duže nego što se zapravo družimo.

Hvala i Jovanu što je doslovno najbolja osoba na svetu, i što je istrpeo moju dosta napornu nevericu povodom te činjenice u onom trenutku kada sam je spoznala. Hvala mu na svakoj diskusiji koja je gušila produktivnost i na razgovorima za koje sam uvek htela da traju duže. Hvala mu i na pojedenom vremenu jer je uvek bilo kvalitetno. Hvala mu i što sve jako detaljno promišlja, to je bilo nagrađujuće i korisno i kvalitetno je jelo vreme. Hvala mu i što je jedna od retkih osoba kojima verujem kad mi kažu nešto lepo, a to je bilo baš važno tokom izrade ove disertacije.

Hvala svim troma na podršci, na putovanjima, na razgovorima, planovima, projektima i na tome što su generalno najbolje kolege praktično u celoj istoriji vremena. Hvala im i što smo napravili nešto važno, ali i na tome što doslovno *ništa nije toliko ozbiljno*. Ova disertacija bi izvesno bila dosta lošija da nema njih, pošto bih ja izvesno bila dosta lošije.

Hvala Psihološkinjama (nasumičnim redosledom jer anti-struktura) - Mariji Kušić, Sandri Ilić, Kseniji Mišić, Kaji Damnjanović, Dunji Paunović i Milici Ninković (opet) - na najbezbednijem mestu na svetu za svaku frustraciju, svaku misao, svaki uspeh i neuspeh i svaki dokaz da je duplo mišljenje najrelevantniji konstrukt na svetu. Ovde posebno hvala Mariji Kušić što uvek misli da sam sto puta pametniji i bolji čovek nego što zapravo jesam, jer sam u cilju očuvanja njene naivnosti bila primorana da se trudim da to i budem (a to mi je baš strašno teško). Hvala joj i što je uvek ubedim da sam u pravu, to je isto jako zdravo za mene.

Hvala Laboratoriji za istraživanje individualnih razlika (ili LIRA labu, ili Laboratoriji za dekomponovanje varijanse (tu imamo praktično dve i po Srbije)) i svim njenim članovima na podršci i prostoru da se bude neozbiljan dok se radi. Hvala posebno Danki Purić, Goranu Opačiću i Goranu Kneževiću što su me zvali da se angažujem u nastavi, jer je to jedan deo doktorskih studija koji sam jako volela, a hvala im i ovako generalno na svemu ikada. Hvala i Predragu Teovanoviću na razumevanju i podršci kad ih baš nisam očekivala, a baš su mi bili potrebni. Hvala i Ljiljani Lazarević, što je Ljiljana, jer svakom kolektivu i čoveku treba jedna Ljiljana. Hvala i svim (mnogim) mladim talentima LIRE i studentima koji su deo Lirinog programa za mlade. Hvala i posebno studentima koji su u evaluacijama za vežbe pisali "slay", jer je u nekim trenucima ovog doktorata to bilo praktično jedino važno.

Hvala Bojani i Vukašinu koji su me našli pored kontejnera (Milica drTM, opet) i usvojili - tema ovog doktorata bi verovatno bila drugačija da nije bilo njih, a svi smo svesni kakva bi to tragedija bila. Hvala Bojani što je apsolutno brilijantna i impresivna, uvek, svuda i u svemu, hvala joj što je pored Milice (opet!!) praktično jedini saradnik sa kojim uvek mogu da radim i hvala joj na tome što se uspešno nosi sa Vukašinovom i mojom beskrajnom potrebom da sve na svetu bude jako neozbiljno. Hvala joj i na striktnom *no bullshit* pristupu kao protivteži mom *almost all bullshit* i Vukašinovom *always complete bullshit* pristupu. Hvala joj i što je bila (i jeste) bezbedno i neosuđujuće mesto za deljenje stvari koje uglavnom ne delim sa drugima. Hvala i Vukašinu na iscrpljujućim, ali nagrađujućim raspravama, na tome što je praktično jedina osoba koja može da me ubedi da nisam u pravu i na tome što modeluje rezilijentnost svima, pa i meni. Hvala mu i što je jedna od retkih osoba za koju kad me zove negde, zaista verujem da želi da budem tamo (čak iako je to uglavnom putem emotivne ucene). Hvala im oboma što su mi omogućili da budem posrednik u mojoj omiljenoj dinamici na svetu.

Hvala i svim ljudima koji su mi pomogli da skupim podatke za ovu disertaciju, kao i svim ispitanicima koji su učestvovali u istraživanjima, sigurna sam da je bilo jako dosadno, te sam im zaista zahvalna na vremenu iako ne znam ko su (ali izvesno sve divni ljudi).

Hvala mojoj drugarici Tijani, na pouzdanosti, na tome što je osoba koja je najduže istrpela prijateljstvo sa mnom (što je složićemo se svi veliki podvig) i na velikom strpljenju za konstantno odsustvo (fizičko i mentalno) tokom izrade ove disertacije. Hvala i Dželi, Olji i Aleksandri što su bile najvažniji deo mojih studija, pa su tako i deo ove disertacije.

Ja imam veliku i jako prisutnu porodicu i hvala im svima na podršci i strpljenju uvek, ali posebno tokom ovih par godina. Ali posebno hvala mojim sestrama i braći: Luki, Anđeli, Dunji, Neveni, Leni, Andreju, Vuku i Mili. Ovde posebno hvala Mili jer je najmlađa, ima godina koliko i ovaj doktorat i

što je u nekim trenucima njegove izrade bila praktično jedini izvor mog mentalnog zdravlja. Hvala i Viktoru što je autentični član iste te jako prisutne porodice, što je jasno iz toga što se konstantno svađamo i bespogovorno mirimo i što sve delimo. Hvala i Aleksandri. Hvala im svima na tome što su prihvatili da često nešto ne mogu jer moram da radim na ovoj disertaciji.

Hvala mojim roditeljima na izdržavanju, konstantnoj podršci i obezbeđivanju svega na svetu. Hvala Braci na knjigama, komunizmu, na razumevanju koje ne delim praktično ni sa kim drugim i na tome što je uvek bio (čak i previše) prisutan otac, čula sam da se to retko sreće. Hvala i mojoj majci isto tako na prisutnosti (jer se to često sreće, a onda se retko hvali), na konstantnoj brizi i pokušaju da me razume (čak i kada je to jako teško) i na tome što mi je prenela duboko usađeno uverenje da izvesno mogu sve sama da uradim jako dobro, bolje od drugih, čak iako to nisam nikad pre radila (ovo je u kontradiktornosti sa onim što sam rekla na početku, ali mora se živeti sa duplim mišljenjem). Hvala im oboma na svemu, a najviše na tome što su mi oprostili što sam upisala psihologiju (dobro, jedno jeste).

Na kraju, hvala mojoj sestri Ani, što često igra ulogu starijeg sibringa, što je moj najveći kritičar, što se konstantno bavi mojim potrebama, što mi uređuje život, što me prizemljuje i što je osetljiva na sve muke svih ljudi ovog sveta. Hvala joj posebno što preuzima na sebe sve što ja ne mogu ili neću (a realno bi trebalo). Izvesno je da verovatno ništa, pa ni ovu disertaciju nikad ne bih završila bez nje i hvala joj na tome, te joj je zato i posvećujem.

Od koga je, dosta je.

Consistently inconsistent: Predictivity and validity of doublethink

Abstract

If a person tends to endorse conflicting beliefs simultaneously, we say they are prone to doublethink. While psychological research, normative logic and our implicit expectations of rationality suggest that people are uncomfortable with inconsistency, we find stable individual differences in the tendency to endorse contradictory beliefs. In this research, we focused on (1) exploring whether doublethink can be predictive of irrational beliefs and their consequences, and (2) understanding the nature of what this tendency is. In a study ($N = 306$) exploring the relation of doublethink and all three groups of irrational beliefs - paranormal, pseudoscientific and conspiratorial - we find that doublethink is positively related to all three. Moreover, since the pandemic provided a unique opportunity to explore the endorsement of contradictory conspiracy theories as they were emerging, we found, across three studies (total $N = 741$) that doublethink had a unique contribution to the prediction of COVID-19 conspiracy theories, over and above other markers of superficial information processing style. We also showed in a separate study ($N = 385$) examining doublethink's ties to non-adherence to medical advice and use of alternative medicine that it was related to neither. We did however find that, while unrelated to trust in science, doublethink was positively correlated with trust in folk wisdom or the "wisdom of the common man". As for our second aim, across different studies, we found doublethink to be robustly related to markers of a more superficial approach to information processing, including intuitive thinking style, pseudo-profound bullshit receptivity, and need for closure, while inversely related to actively open-minded thinking, cognitive reflection, and syllogistic reasoning. While doublethink showed no significant relation to executive functions like shifting and updating after accounting for other superficial style variables, we did find it to be related to the more specific ability of spotting inconsistencies, across two studies ($N = 234$; $N = 315$), suggesting an overall lack of sensitivity to contradictions. This is what we focused on in three separate experimental studies (total $N = 1071$) - addressing this lack of sensitivity to contradictions through increasingly direct strategies to tackle inconsistent beliefs. Our interventions did not, however, reduce doublethink. To gain insight as to why the experimental studies yielded no results, we conducted semi-structured interviews with participants ($N = 15$) to explore how they reason about their inconsistent beliefs, and found the participants to be aware that their beliefs are contradictory yet also to not attach any negative value to that state of affairs. Instead, they relied on rationalizing the contradictions through various strategies. Overall, we find that doublethink is, paradoxically, a permissive, yet rigid thinking style, that helps allow different beliefs to enter the system without much filter and cross-referencing, but then also rarely includes belief revision and updating within the belief system itself. Our findings challenge the notion of consistency as a core motive, and instead suggest tolerance of belief contradictions as at times adaptive thinking style, but one that is also a key mechanism for maintaining epistemic vulnerability to irrational beliefs and their persistent existence.

Keywords: doublethink, belief inconsistency, irrational beliefs, superficial information processing, belief revision

Scientific field: Psychology

Scientific subfield: Social psychology

UDC number:

Dosledno nedosledni: priroda i prediktivnost konstrukta duplog mišljenja

Sažetak

Ako osoba istovremeno podržava međusobno suprotstavljena uverenja, kažemo da je sklona *duplom mišljenju* (engl. *doublethink*). Iako psihološka istraživanja, pravila normativne logike i naša implicitna očekivanja racionalnosti sugerišu da je ljudima protivrečnost neprijatna, naša istraživanja sugerišu da postoje stabilne individualne razlike u sklonosti da se podržavaju kontradiktorna uverenja. U ovom istraživanju ispitali smo: (1) da li duplo mišljenje može da bude prediktor iracionalnih uverenja i njihovih posledica, i (2) prirodu ove kognitivne sklonosti. U korelacionoj studiji ($N = 306$) ispitali smo odnos između duplog mišljenja i tri glavne grupe iracionalnih uverenja – paranormalnih, pseudo-naučnih i zavereničkih – i pokazali da je duplo mišljenje povezano sa sve tri. Uz to, pandemija je pružila jedinstvenu priliku da se ispita podrška kontradiktornim zavereničkim narativa dok su se pojavljivali, pa smo kroz tri studije (ukupno $N = 741$) pokazali da duplo mišljenje značajno doprinosi predviđanju verovanja u zavere o kovidu-19, povrhu drugih pokazatelja površnog stila obrade informacija. U posebnoj studiji ($N = 385$) ispitali smo odnos između duplog mišljenja i nepridržavanja medicinskih preporuka, kao i korišćenja alternativne medicine, ali nismo našli povezanost ni sa jednom grupom ponašanja. Pokazali smo i da duplo mišljenje nije povezano sa poverenjem u nauku, ali jeste pozitivno povezano sa poverenjem u narodnu mudrost, tj. „mudrost običnog čoveka“. Radi ispitivanja drugog cilja ove disertacije, kroz više studija pokazali smo i da je duplo mišljenje dosledno povezano sa pokazateljima površnog stila obrade informacija, uključujući intuitivno mišljenje, prijemčivost za pseudodubokoumne verbalizme (engl. *pseudo-profound bullshit receptivity*) i potrebu za kognitivnim zatvaranjem, dok je negativno povezano sa aktivnim mišljenjem otvorenog uma, kognitivnom refleksijom i sposobnošću silogističkog zaključivanja. Duplo mišljenje nije bilo povezano sa egzekutivnim funkcijama poput premeštanja (*shifting*) i ažuriranja (*updating*), ali jeste sa slabijom sposobnošću prepoznavanja nedoslednosti u dve studije ($N = 234$; $N = 315$), što upućuje na opštu neosetljivost na protivrečnosti. Zbog toga smo sprovedi tri eksperimentalne studije (ukupno $N = 1071$) koje su kroz različite pristupe pokušale da direktno adresiraju ovu neosetljivost na protivrečnost i smanje nivo duplog mišljenja. Nijedna od intervencija nije imala efekta. Da bismo razumeli zašto intervencije nisu bile uspešne, sprovedi smo polustrukturirane intervjue sa učesnicima ($N = 15$) kako bismo ispitali na koji način rezonuju o sopstvenim kontradiktornim uverenjima. Učesnici su uglavnom bili svesni da su njihova uverenja kontradiktorna, ali nisu tu pojavu negativno evaluirali. Umesto toga, oslanjali su se na racionalizaciju protivrečnosti kroz različite strategije. Ukupno gledano, pokazali smo da je duplo mišljenje paradoksalan stil mišljenja – permisivan u pogledu prihvatanja različitih, pa i kontradiktornih uverenja, ali rigidan kada je reč o njihovoj reviziji i međusobnom usaglašavanju. Naši nalazi dovode u pitanje ideju da je težnja ka doslednosti osnovni kognitivni motiv i umesto toga sugerišu da tolerancija na protivrečnost može ponekad biti adaptivna. Međutim, duplo mišljenje je i ključni mehanizam za održavanje epistemološke ranjivosti na iracionalna uverenja i njihovu istrajnost.

Ključne reči: duplo mišljenje, nedoslednost uverenja, iracionalna uverenja, površni stil obrade informacija, revizija uverenja

Naučna oblast: Psihologija

Uža naučna oblast: Socijalna psihologija

UDK broj:

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“In its rational form, dialectic [...] includes in its comprehension and affirmative recognition of the existing state of things, at the same time also, the recognition of the negation of that state, of its inevitable breaking up; because it regards every historically developed social form as in fluid movement... and is in its essence critical and revolutionary.”

— Karl Marx, *Capital*, Vol. I, Afterword to the Second German Edition

This thesis explores how contradiction persists not only in systems — but in minds.

Chapter 1

Introduction

Introduction

Imagine you are having a lively discussion with a friend in which you are firmly arguing for your belief that *voting should be obligatory for everyone*. Your friend argues that everyone is allowed freedom of choice and that no one should be obligated to do anything, let alone vote. They argue that, for example, a person might feel that they do not have anyone adequate to vote for, or that all the candidates are more or less the same. You find that this notion just further supports your lifelong belief that *some people should clearly not be allowed to vote*, which you proudly point out to your friend. With a victorious glint in their eye, they in turn claim you have just made the discussion moot, as you've simultaneously argued for two contradictory beliefs. With a flash of horror, you realize that you had just effectively lost the argument, and not to the other side's refutation but to your own inconsistency, leaving you to sit with the unsettling feeling of having incompatible beliefs. At the same time, you also start to realize that you *do* believe *both* those things *to be* actually true, despite their clear contradiction. You find yourself wanting to defend both beliefs and that, upon reflection, the contradiction does not dissolve with it - it persists.

If a person is prone to such mutually incompatible beliefs, we say they are prone to doublethink (Petrović & Žeželj, 2022), by borrowing from Orwell (as in Irwin, Drinkwater, et al., 2015) or to belief inconsistency (Irwin, Dagnall, et al., 2015). Initial findings suggest that there are stable individual differences in this tendency to endorse mutually contradictory beliefs at the same time. However, the notion that people can be inconsistent in their beliefs stands in stark contrast with postulates of normative logic where reasoning from inconsistency is automatically invalid, as well as a range of psychological findings on consistency that further suggest that we should be uncomfortable when contradictory (e.g., Festinger, 1957; Heider, 1946). Consistency is embedded into our implicit ideas of rationality, as it is one of the often-ascribed traits to rational and reasonable people (Grossmann et al., 2020). It is also a key part of rhetoric in public debates, where one way to dismiss an argument is to directly attack it by, for example, examining if it's consistent with facts or what was previously said (Ericson et al., 2003).

Is it then even possible to endorse contradictory beliefs simultaneously? Can this be examined as a trait-like tendency? Are there belief systems that are particularly susceptible to inconsistencies? Is this tendency malleable? How do people perceive and reason about their inconsistent beliefs? Is inconsistency really unsettling for people, or is it readily tolerated? This thesis will help provide evidence-based answers to these questions.

Consistency as a normative and psychological imperative

In classical logic, consistency is a prerequisite for rational and valid inference. In fact, the law of non-contradiction is a core principle in logic, one that is impregnable (Aristotle, 350 B.C.E / 1984). According to it, a proposition cannot be both true and false at the same time, i.e. an attribute cannot both apply and, simultaneously, not apply to an object. Consistency is a central concept in classical reasoning and underpins many formal demonstrations, for example the *reduction to absurdity* (e.g., Aristotle, 350 B.C.E / 1984; Copi et al., 2011; Enderton, 2001). This is a form of logical proof where the proposition is first negated and then a contradiction is derived from that negation, thus proving that the original statement has to be true. This method relies on the principle of explosion, where anything can follow from two inconsistent premises - once a contradiction is acknowledged, the system collapses, because anything can be proven if we were to accept an inconsistency as true (Klenk, 2007; Priest, 2006). So, if we were to adopt this classical logic framework, a *rational* agent **could not** hold two mutually incompatible beliefs.

Not only that but seminal psychological work would suggest that people are actively uncomfortable with inconsistency, and once they encounter it in their beliefs and behaviors, they strive to alter one of the incongruent elements to achieve coherence again. According to Heider's (1946) balance theory, our cognitions (i.e. our attitudes, beliefs, representations of our behavior) tend to exist in a balanced state, meaning they are organized in internally compatible constellations. The theory focuses on constellations of either two or three elements, and defines a balanced configuration as the one where the elements within the constellation are mutually compatible. For example, say that a person genuinely opposes gambling, but they recently got a job where they develop software for gambling platforms. This creates an imbalanced state, as a person's behavior (their work) is incongruent with their beliefs. Or say that a person strongly believes that abortion is a universal right and that they recently met someone they really liked. An imbalanced state could arise if they discover that that person believes that abortion should be illegal. Balance theory suggests that in cases as the ones described above - cases of an imbalanced state - tension arises, that then pushes the constellation towards reorganization. In our first example, the person can either cognitively restructure the field, for example by trying to convince themselves that gambling can also be fun, thus changing the dynamic property of this element (i.e. instead of a genuine dislike, their belief might become more neutral) or they can remove one of the elements, for example, by finding a new job. Similarly, in the other example, a person can either rationalize that, just because a person holds a view they find unacceptable, this does not automatically make them a bad person, or they can revisit their beliefs about abortion or even decide that they do not want to be friends with that ill-suited person. The theory, however, does not discuss relations between different internally consistent constellations, and instead exclusively focuses on the relation between a limited number of cognitive elements. Nevertheless, in general, it suggests that people strive for cognitive consistency, and that inconsistency represents a state that needs to be addressed and altered. It is plausible to assume that people strive not only for internal consistency within configurations, but also for congruence between them, as well as across elements of different constellations. Alternatively, consistency might be limited to a finite number of elements within compartmentalized configurations, allowing for inconsistencies to arise between elements of such broader, disconnected groups of cognitive elements.

An even more direct examination of how people strive towards consistency can be found in Festinger's (1957) cognitive dissonance theory. Similarly to what is proposed in balance theory, cognitive dissonance theory suggests that people aim towards consistency between their cognitions, such as beliefs or attitudes. This state of affairs, where our cognitions are congruent, is labelled as a state of cognitive consonance and is supposedly the usual state in which our cognitive field is in i.e. consistency is a general, expected rule within our belief system (Festinger, 1957). Inconsistencies do happen, and when two or more elements (say two of our beliefs) are incompatible, this is considered a dissonant state. This state is for a person *automatically* uncomfortable, meaning it's a state that motivates people towards change, in order to resolve the discomfort and achieve a consonant state again. This would suggest that inconsistency is inextricable from the unpleasant (and motivating) feeling of dissonance. Cognitive dissonance is researched through different paradigms with three being the most typically used: (1) induced compliance with minimal external justification, (2) effort justification and (3) post-decision paradigm (Harmon-Jones & Mills, 2019). In the *induced compliance paradigm*, participants are induced to act or say things that are in discrepancy with their personal beliefs. Research suggests that in such cases, people tend to adjust their attitudes to be more congruent with what they have done. In one of the first experiments within this paradigm (Festinger & Carlsmith, 1959), students were asked to participate in really boring tasks. They were then sorted either into the control condition, the \$1 condition, or the \$20 condition. In the two experimental conditions, the participants had to (either for a \$1 or \$20 reward) promote the tasks as fun to students who were about to participate in them for the first time (who were actually confederates of the researchers). The results show that the participants who had to promote an attitude that they disagreed

with had significantly more positive evaluations of the tasks relative to the control group. This only happened in the group that received a smaller compensation, as the other group is thought to have had enough of an external justification to justify their behavior (Festinger & Carlsmith, 1959). As for the first group, as their behavior was contradictory to their beliefs, they adjusted their beliefs to be more aligned with their behavior to reduce the dissonance. The *effort justification paradigm* suggests that when people have to put in more effort into an otherwise unconvincing outcome, they afterwards rate that outcome more favorably in order to overcome the dissonance. For example, Aronson & Mills (1959) show that when participants have to go through a more severe initiation to a new group (in this case, a more embarrassing one), they tend to like that group more afterwards relative to the control group. Finally, in the *post-decision paradigm*, the participants are given a choice between two alternatives that are equally attractive to them and told to choose one of them, after which they evaluate their preference for the options again. Their preference for the non-chosen option typically diminishes, while the preference for the chosen option rises (Festinger, 1962). This effect stems from the fact that the choice is now dissonant with the attractive aspects of the non-chosen alternative and the non-attractive aspects of the chosen alternative. To reduce tension that arises from such incongruencies, the non-chosen option becomes less attractive. All of these examples attest to the idea that inconsistency, once encountered, needs to be dealt with, and in a similar manner as postulated by balance theory - for example by removing inconsistent cognitions altogether or by reducing their importance (Harmon-Jones & Mills, 2019). These findings would suggest that contradictions are either relatively apparent to people, or if not, these processes seem to be happening almost automatically. This means that holding simultaneously contradictory beliefs should be relatively rare.

The theory has, however, evolved from Festinger's initial proposition, allowing for some exceptions to the "consistency default". In fact, in one of the previously described experiments (Festinger & Carlsmith, 1959) the participants in the \$20 condition did not show the usual dissonance effect, meaning that sometimes, inconsistency can be tolerated. One of the key distinctions that was made in the theory since its initial set up is the distinction between cognitive inconsistency and dissonance, which for Festinger were necessarily coupled. Cognitive inconsistency is instead defined as the relation between two cognitions (two beliefs for example), while dissonance is the undesirable, psychologically unpleasant, motivational state that pushes a person to revise these cognitions (Harmon-Jones & Mills, 2019). This distinction is important because it allows, potentially, for the simultaneous existence of incompatible cognitions, which if the dissonance component is missing, does not automatically lead to the resolution of these inconsistencies.

Reexaminations of the theory have actually gone on to specify exactly that - inconsistency on its own is not enough to trigger dissonance effects, but rather there are different conditions that need to be met in order for dissonance to arise and spark attitudinal change. It has been proposed that it is, for example, not the perception of inconsistency that leads to attitudinal change, but rather threats to self-esteem (e.g. Aronson, 1999). This would suggest that the idea of being hypocritical is what is driving the dissonance, rather than inconsistency per se. Similarly, and more broadly, it has also been argued (Cooper & Fazio, 1984) that what brings about dissonance is the expectation or knowledge of bringing about aversive consequences. In the examples we discussed above, the fact that the students had to deceive someone, or the potential that a wrong choice was made between two attractive alternatives produces the feeling of dissonance, rather than the inconsistency itself. Kruglanski and colleagues (2018) also challenge the notion that consistency is a fundamental universal need, and suggest that the negative affect that is documented in dissonance studies (this unpleasant feeling that motivates people to adjust their incongruent cognitions) does not stem from the inconsistency itself. Rather it is the lowered expectancy of a desired outcome that triggers these feelings. For example, in the *induced compliance paradigm*, the negative affect does not arise because of inconsistency, but rather from the idea that we are being hypocritical or dishonest i.e. the new information is not

problematic because it is inconsistent, but because it is “bad news”. One can then imagine that there are inconsistencies that persist because they increase the expectancy of a desirable outcome, and thus do not provoke the negative affect that motivates a person to somehow rearrange their cognitions

Taken together, these addendums to the cognitive dissonance theory seem to suggest that consistency is not actually such a universal need within the belief system. What is more, there are both logic and belief systems that tolerate and incorporate inconsistencies with relative ease.

Inconsistency as a computational and rational necessity

As mentioned in the previous section, classical logic systems do not tolerate inconsistency, as anything can follow once a contradiction is accepted. There are however logical systems that treat inconsistency as potentially informative, such as paraconsistent logic (Priest et al., 2018). Paraconsistent logic has its application in formal explorations of belief revision i.e. the study of how beliefs are rationally updated. One of the reasons why paraconsistent logic is employed is because it is assumed that in real-life applications, inconsistency is unavoidable, as for example, an agent might adopt several beliefs from different sources that are incompatible with each other and endorse them until new information arises that can resolve the contradictions (Schwind et al., 2022).

In fact, given the amount of information and beliefs that we intake and endorse, full belief consistency seems highly unlikely and even computationally impossible. Some authors argue that the most consistency that we can hope for is within a limited set of beliefs (around five to seven) that are simultaneously activated when new information is incoming (Sommer et al., 2023). Moreover, while detection of inconsistency can lead to belief revision, this is not always the case. When faced with new information, we try to find a single mental model that can incorporate all of the propositions, i.e., both the new fact and our previous beliefs. The more models we have to examine, the harder the task, which can sometimes yield illusions of consistency when there is none, thus allowing inconsistencies to persist (Johnson-Laird et al., 2004). This suggests that we do not systematically review all our beliefs when forming new ones, enabling contradictory beliefs to coexist within a belief system. This is further compounded by the fact that we often outsource knowledge to others, which creates a sense of knowing without personal understanding (Sloman & Fernbach, 2017). This can help maintain a subjective sense of coherence—even when our personal belief systems contain internal contradictions. Not only that, but once we try to explain an inconsistency, it becomes harder for us to detect it later on. Even when the inconsistency is made salient, one can generate an explanation to reframe it - usually this is done by framing inconsistencies as exceptions to generalizations that are accepted by default (Khemlani & Johnson-Laird, 2012). For example, if a person believes that acupuncture can heal anxiety, and then meets a person with anxiety that tried acupuncture and it did not work for them, they will try to explain away this inconsistency by saying that this person did not try acupuncture for long enough, or with the right practitioner or even that they just have a resistant type of anxiety. In fact, in this view, the robustness of beliefs to inconsistencies is a rational principle (Gershman, 2019) that functions as a Bayesian model of cognition in which central beliefs are protected by the generation of auxiliary beliefs (i.e. modifications or additions to the central belief). When faced with an inconsistency, we can generate auxiliary ones that incorporate the inconsistency without abandoning the central belief.

Some theories even go beyond defining incorporation of inconsistency as a rational, belief-protecting mechanism, but consider it a broader reflection of epistemic flexibility. According to this view, inconsistency does not need to be rationalized or protected through auxiliary hypotheses - people can simply simultaneously rely on and draw from different, even contradictory knowledge systems and representations, which is labeled as cognitive polyphasia (e.g., Jovchelovitch, 2008; Jovchelovitch & Priego-Hernández, 2015). Instead of framing this as an erroneous aspect of the belief

system, the authors exploring cognitive polyphasia consider it a useful and necessary way to handle complexities of the social world (Jovchelovitch & Priego-Hernández, 2015). Depending on the context, individuals may switch between conflicting (e.g., scientific, traditional, or spiritual) rationalities, adapting their epistemic stance to what the environment demands. Inconsistencies can then lead to either polyphasia or dissonance, depending on individual differences in, for example, self-monitoring (Martinez, 2018).

So far, we illustrated that people vary in how they respond to inconsistency: with dissonance or polyphasia or doublethink. However, there are also individual differences in how frequently they exhibit these responses. This variability can be linked to how much people value consistency in themselves and others, reflected in *preference for consistency* (Cialdini et al., 1995). This preference is usually assessed through self-report measures, with participants being asked to declare if they find it uncomfortable to encounter inconsistency in themselves and others. However, the opposite end of the spectrum has not been extensively studied so far - preference for inconsistency is not simply the inverse of preference for consistency. Moreover, if we consider what we have so far established about tolerance of inconsistency, it is unclear if people would be able to accurately report whether or not they prefer consistency. What is more, their preference might not be related to the amount of contradictory beliefs they hold - someone could nominally report that they dislike inconsistency without any particular effort, but they can still harbor actual contradictory beliefs (Petrović & Žeželj, 2022). This is why focusing on the inconsistency side of the spectrum is useful - it allows for the development of a measure that consists of pairs of contradictory beliefs. Instead of reporting if they *like* consistency or not, the participants just report how much they endorse a certain belief. The score is then derived from examining the relation between contradictory pairs - if a person believes both contradictory statements, this would be categorized as doublethink. This measure then directly assesses tolerance of inconsistency (Petrović & Žeželj, 2022) rather than merely stating a preference for it. It demands more cognitive resources, which, given the discussed capacity needed to maintain consistency, makes it a well-calibrated tool for evaluating doublethink.

So given the constraints, consistency seems to be unlikely in the belief system, incorporation of inconsistencies and their rationalization seem to be a part of a rational process of belief formation and revision, and this ability to tolerate and reconcile contradiction is sometimes considered a feature rather than a fault. If inconsistency is to some extent inevitable, the pressing question is not whether people endorse contradictory beliefs, as they clearly do, but what are the consequences of doublethink. While some inconsistent beliefs may be harmless or adaptive, certain belief systems—such as pseudoscientific, conspiratorial, or paranormal beliefs—may be especially laden with contradictions, yet these beliefs are still endorsed with conviction. Doublethink then becomes a mechanism that sustains such beliefs, despite a range of detrimental consequences that they can have, such as political violence, perpetuation of prejudice, non-adherence to medical advice and use of questionable health practices.

Irrational beliefs and contradictions

Irrational (Žeželj & Lazarević, 2019) or epistemically suspect (Pennycook et al., 2015) beliefs refer to a range of beliefs that do not comply with principles of normative logic, lack a solid-evidence base and are generally not in line with most commonly held ontological assumptions about reality (Žeželj & Lazarević, 2019). While the literature classifies numerous different beliefs under this umbrella term, there seems to be a relative consensus that they can be sorted into three broad categories (Rizeq et al., 2021; Teovanović et al., 2024; Šrol, 2022): paranormal (e.g., beliefs about ghosts or telekinetic abilities), pseudoscientific (e.g., beliefs about laws of attraction or morphic fields and cell memory) and conspiratorial beliefs (e.g., beliefs that HAARP is a secret weapon used for mind control/weather manipulation or that the pharmaceutical industry is intentionally hiding the cure

for cancer). While diverse content-wise, these beliefs are highly correlated, forming what we can refer to as an irrational mindset (e.g., Purić et al., 2025; Knežević et al., 2024).

From the very definition of these beliefs as non-conforming to normative rationality, it is not surprising that they might be particularly prone to contradictions. This has been mostly demonstrated in the domain of conspiratorial beliefs (e.g., Lewandowsky et al., 2011; Lukić et al., 2019; Wood et al., 2012). Research suggests that people can simultaneously endorse conspiracy theories whose content is mutually inconsistent (Lukić et al., 2019; Miani & Lewandowsky, 2024; Petrović & Žeželj, 2022; Wood et al., 2012), for example, that Princess Diana is still alive and that she was killed by MI6 or endorsing the idea that the coronavirus has been accidentally released by China but also by the US (Miller, 2020). Moreover, the tendency to endorse contradictory beliefs (i.e. doublethink) has already been shown to be related both to belief in specific conspiracy theories (e.g., that trails left behind airplanes ('chemtrails') poison people) and the more general propensity towards conspiratorial thinking or interpreting important events as secret plots orchestrated by malevolent groups (Irwin, Dagnall et al., 2015; Petrović & Žeželj, 2022).

Why is a tolerance of contradictions a part of the irrational mindset? Research so far has been almost exclusively focused on conspiratorial thinking when exploring contradictory beliefs. These findings suggest that the simultaneous endorsement of contradictory conspiracy theories is a reflection of a superordinate, core belief that the official version of events is not true (Lukić et al., 2019; Wood, 2017). Given that irrational beliefs, such as conspiratorial ones, are entrenched and hard to refute (Cichocka, 2020) and can be core identity beliefs fulfilling various motives (Douglas et al., 2020), contradictions in specific conspiracy theories that support such central, higher order narratives are more easily tolerated. So, a person might believe that the official narrative about Princess Diana is not true, and can then endorse both the theory that she was killed by the MI6 and that she is still alive, as both are congruent with the superordinate belief (that the official explanation is not true) and seem equally likely to the person. While this has not been empirically tested so far, it is possible to draw similar parallels with other irrational beliefs. A person who believes that *mainstream knowledge is flawed and that we need alternative modes of knowledge* (i.e. someone prone to pseudoscientific beliefs) might simultaneously believe their fate to be predetermined by astrology while also believing in the law of attraction and the ability to manifest outcomes (regardless of the stars). While mutually incompatible, these beliefs are congruent with the superordinate, core belief of pseudoscience. In spite of this example, research relating the endorsement of contradictory beliefs to irrational beliefs other than conspiratorial ones is scarce. Given these beliefs are also often inherently contradictory, doublethink might be an important information processing mechanism that allows for their coexistence. In fact, previous findings suggest that superficial information processing is related to all types of irrational beliefs, so doublethink's relation to irrational beliefs might be best understood if we consider doublethink within the context of this superficial information processing style.

Doublethink as a superficial information processing style

Superficial information processing style (e.g., Fonseca et al., 2014) can be operationalized in different ways, but in general it represents a quicker, more intuitive, less focused processing of different types of information. It is relatively well documented that all types of irrational beliefs are related to such information processing - for example, all three types of irrational beliefs are related to less analytical but more intuitive thinking style (e.g. Fasce and Pico, 2018; Majima, 2015; Svedholm and Lindeman, 2012, Yelbuz et al., 2022) and those prone to irrational beliefs are also less likely to revise their beliefs in light of new evidence i.e. they are less actively open-minded (e.g., Knežević et al., 2024; Newton et al., 2023; Rizeq et al., 2021). Irrational beliefs are also related to cognitive biases (e.g., Teovanović et al., 2024; Šrol, 2022), and ontological confusions about the world (e.g. Lindeman et al., 2015; Rizeq et al., 2021). Simultaneously, doublethink was also shown to be related to less

analytical and more intuitive thinking style (Petrović & Žeželj, 2022), and as such it can be conceptualized as a disheveled thinking style, where a person is more lenient towards contradiction. Those high in doublethink could thus be prone to tolerate contradictions and adopt any belief, without really cross-checking them for consistency, allowing them to enter and persist in the belief system.

This is however not the only possibility. Those high in doublethink could possibly be unaware of the contradictions within their belief system, as a consequence of a lesser ability to spot inconsistencies. Both of these interpretations suggest a certain insensitivity to inconsistency and do not have to be mutually exclusive but could be superposed tendencies, leading to more contradictory beliefs within the belief system. While there are some initial findings relating doublethink to thinking styles (Petrović & Žeželj, 2022), there is a need to replicate these findings and examine which aspects of superficial information processing style are the most prominent correlates of doublethink, in order to better understand its nature. Additionally, there is no research examining how doublethink is related to the ability to spot inconsistencies nor is there an attempt to examine its relations to both thinking style and this ability within a single design, in order to check whether one can make the other obsolete - i.e. whether we can label doublethink as predominantly one or the other. Moreover, the relation of doublethink to thinking styles and the ability to spot inconsistencies raises more important conceptual questions. One of the triggers of cognitive dissonance is the perception of inconsistency - this perception then leads to the psychological discomfort that leads to attitude change. If people are unable to spot inconsistencies in general or can more easily ignore them, they might be able to do the same in their beliefs. This would suggest that doublethink might be malleable if people are made aware of the contradictions in their beliefs. At the same time, if doublethink represents an active tolerance of contradiction, those highly prone to it may not just overlook consistency, but also incorporate them more fluidly, even accepting their presence with relative ease.

Do we need to reduce doublethink and can it be done?

If doublethink is, as mentioned, not inherently problematic, and if it is just another consequence of the computational constraints of our information processing, why would it be important to develop strategies to reduce it? As mentioned, there are indications that doublethink is related to irrational beliefs. These beliefs have a range of negative consequences such as for example vaccine hesitancy (Jolley et al., 2022), readiness to commit political violence (Imhoff et al., 2021), prejudices and stereotypes (Biddlestone et al., 2020) and most prominently, questionable health behaviors, such as intentional non-adherence to medical recommendations (e.g., deciding which prescribed therapy to take or not to take, self-medication) and use of traditional, complementary and alternative medicine (Knežević et al., 2024; Lazarević et al., 2023; Purić et al., 2022; 2025). These are particularly interesting as people tend to simultaneously use both official and alternative medicine, despite them often being juxtaposed with one another (e.g., Aikins, 2005; Jovchelovitch & Gervais, 1999; Pew Research Center, 2017). Additionally, correlations between intentional non-adherence to recommendations and use of alternative medicine, while positive, are not high (r s around .30; Knežević et al., 2024; Lazarević et al., 2023; Purić et al., 2025), suggesting the possibility of relying on both official and alternative medicine simultaneously (Tangkiatkumjai et al., 2020), despite their overt incongruence. Going even further, this tolerance of contradictions might lead to moral relativization (e.g., lauding freedom of speech as an inviolable right, but approving of censorship when it targets views one disagrees with) or the formation of double standards for different groups. This is particularly important as some ideological belief sets, such as authoritarianism, seem to be conducive to simultaneous acceptance of contradictions (Altemeyer, 1996; Petrović et al., 2024) through the compartmentalization of beliefs and a lack of their cross-reference (Altemeyer, 1996).

As irrational beliefs are, despite efforts, generally hard to reduce (e.g. Većkalov et al., 2024), there is a need for more mechanisms to tackle them. One potential avenue to do so is to tackle the

more general tendencies of information processing that are thought to be underlying them. Debiasing techniques (Isler & Yilmaz, 2022) that focus on explaining how cognitive biases work and making them more salient to people can successfully elicit reflective thinking and subsequently lower irrational beliefs (Bayrak et al., 2025). If doublethink shows a robust relation to irrational beliefs, targeting doublethink in interventions could potentially reduce irrational beliefs and consequently their consequences. If people just need to be made aware of inconsistencies, doublethink can be addressed more straightforwardly, by pointing these contradictions out to people or training them to be more sensitive to them. If instead people can acknowledge contradictions, but still easily explain them away, reducing doublethink might prove to be more complex.

Previous findings (Lukić et al., 2019) suggest that people employ different strategies to explain their inconsistent beliefs. As previously discussed, the nature of irrational beliefs allows for inconsistency to be handled through the structure of the belief system, with more specific, lower order conspiracy beliefs being congruent with higher order ones, even if not between each other (Lukić et al., 2019; Wood, 2017). Doublethink, however, as we have discussed it so far, entails a more general propensity towards inconsistent beliefs. This propensity is content independent, since doublethink refers to the relation between beliefs rather than the content of those beliefs. If doublethink can arise from any type of belief, this strategy of generating a higher order belief that can subsume both inconsistent ones is not applicable. Take for example the belief that *some people are irreparable* and the belief that *every person has the potential to change*. There is no obvious superordinate belief that you can generate that would explain why these beliefs would be simultaneously endorsed. And yet, previous studies show that they are (Petrović & Žeželj, 2022). As such, it is unclear what previously identified strategies, if any, might be applicable to doublethink if we conceptualize it as a general, content-independent tendency. It is possible that previously discussed strategies - such as generating auxiliary hypotheses or framing inconsistencies as an exception to the rule - may also emerge as ways to explain inconsistency. However, these have not been previously examined within such a design nor in the context of individual differences of doublethink. Either way, understanding how people perceive their own inconsistent beliefs and how they reason about them is another crucial aspect of understanding the nature of the endorsement of contradictory beliefs and why it arises.

Rationale and research aims

The aim of this dissertation was to explore (1) the predictivity and (2) the nature of doublethink, defined as the proneness to simultaneously endorse mutually incompatible beliefs. To do so, we had several research aims. Firstly, to examine the predictive role of doublethink for irrational beliefs and their consequences, we investigated its relationship with three domains of irrational beliefs: paranormal, pseudoscientific, and conspiratorial. The pandemic provided a natural experiment in how contradictory conspiracy theories in particular arise in times of great uncertainty and information overload that made it a fertile ground for the proliferation of conflicting narratives that were hard to navigate. As new information was incoming, conspiracy theories accumulated, and a lot of them were incompatible with each other. As such, we identified the most commonly represented conspiratorial themes about the pandemic (for example, that the severity of the virus was not as presented) and generated contradictory conspiracy beliefs in those domains. Our aim was to examine (a) if people can endorse incompatible conspiracy theories about the pandemic but also (b) if this tendency can be explained by doublethink as a general tendency to tolerate inconsistent beliefs. Finally, to examine the potential behavioral outcomes of doublethink, we explored if doublethink can be predictive of questionable health behaviors (both non-adherence to official recommendations and use of alternative medicine) and, more specifically, if it can explain simultaneous reliance on both conventional and alternative medicine, as they are often portrayed as epistemically incompatible. To tackle our second aim of better understanding the nature of individual differences in doublethink, we examined its relationship with superficial information processing styles and sensitivity to

inconsistency—investigating whether the construct primarily reflects one or the other. On the one hand, doublethink can be a part of the superficial information processing style reflected in a tendency to tolerate contradictory beliefs. On the other, contradictory beliefs might arise because a person lacks the ability to spot inconsistencies. These two explanations need not be juxtaposed - both superficial information processing style and the ability to spot inconsistencies can represent an insensitivity to inconsistencies, while doublethink can entail both to an extent. We also assessed whether doublethink can be reduced through interventions that vary in the degree in which they explicitly confront people with their own inconsistent beliefs. Finally, we explored how individuals perceive, rationalize, and potentially self-correct their own contradictions. Employing correlational, experimental and qualitative methodologies, the 11 studies that comprise this thesis aim to elucidate the nature of the construct and help situate it within the larger field of irrational beliefs and their consequences.

The thesis consists of a total of three papers that have been categorized by the Serbian Ministry of Education, Science, and Technological Development as M21a, M21, and M22. We present an outline of the papers and studies in Table 1 below. The thesis is split into different chapters, each corresponding to the accepted version of the papers.

Table 1
Overview of papers and studies

Doublethink as a predictor of irrational beliefs						
<i>Paper 1: Exploring the mechanisms that allow incompatible beliefs to coexist in the cognitive system: how doublethink relates to thinking styles and syndromes of irrational beliefs</i>						
	Study 1	Study 2				
Study type	Correlational					
Sample size	Community sample of $N = 306$ Serbian participants	Community sample of $N = 385$ Serbian participants				
<i>Paper 2: Both a bioweapon and a hoax: the curious case of contradictory conspiracy theories about COVID-19</i>						
	Study 1	Study 2	Study 3			
Study type	Correlational					
Sample size	Community sample of $N = 290$ Serbian participants	Community sample of $N = 281$ Serbian participants	Community sample of $N = 170$ Serbian participants			
The nature of doublethink as a trait						
<i>Paper 3: Inconsistent yet unyielding: Persistence of contradictory beliefs and strategies for their reconciliation</i>						
	Study 1.1	Study 1.2	Study 2.1	Study 2.2	Study 2.3	Study 3
Study type	Correlational		Online experiment; mixed design, 2 (between subjects) x 2 (within subjects)			Qualitative
Sample size	Community sample of $N = 234$ Serbian participants	Community sample of $N = 315$ Serbian participants	Community sample of $N = 348$ Serbian participants	Community sample of $N = 431$ Serbian participants	Community sample of $N = 292$ Serbian participants	Student sample of $N = 15$

Chapter 1 References

- Aikins, A. de-Graft. (2005). Healer shopping in Africa: New evidence from rural-urban qualitative study of Ghanaian diabetes experiences. *BMJ*, *331*(7519), 737. <https://doi.org/10.1136/bmj.331.7519.737>
- Aristotle. (1998). *Metaphysics* (H. Lawson-Tancred, Trans.). Penguin Books.
- Aronson, E. (1999). Dissonance, hypocrisy, and the self-concept. In E. Harmon-Jones & J. Mills (Eds.), *Cognitive dissonance: Progress on a pivotal theory in social psychology*. (pp. 103–126). American Psychological Association. <https://doi.org/10.1037/10318-005>
- Aronson, E., & Mills, J. (1959). The effect of severity of initiation on liking for a group. *The Journal of Abnormal and Social Psychology*, *59*(2), 177–181. <https://doi.org/10.1037/h0047195>
- Bayrak, F., Sümer, V., Dogruyol, B., Saribay, S. A., Alper, S., Isler, O., & Yilmaz, O. (2025). Reflection predicts and leads to decreased conspiracy belief. *Cognition*, *258*, 106085. <https://doi.org/10.1016/j.cognition.2025.106085>
- Biddlestone, M., Cichočka, Aleksandra, Žeželj, I., & Bilewicz, Michał. (2020). Conspiracy theories and intergroup relations. In Michael Butter & P. Knight (Eds.), *Routledge handbook of conspiracy theories*. Routledge.
- Cialdini, R. B., Trost, M. R., & Newsom, J. T. (1995). Preference for consistency: The development of a valid measure and the discovery of surprising behavioral implications. *Journal of Personality and Social Psychology*, *69*(2), 318–328. <https://doi.org/10.1037/0022-3514.69.2.318>
- Cooper, J., & Fazio, R. H. (1984). A New Look at Dissonance Theory. In *Advances in Experimental Social Psychology* (Vol. 17, pp. 229–266). Elsevier. [https://doi.org/10.1016/S0065-2601\(08\)60121-5](https://doi.org/10.1016/S0065-2601(08)60121-5)
- Copi, I. M., Cohen, C., & MacMahon, K. (2014). *Introduction to logic* (14 ed., Pearson new international ed). Pearson Education Limited.
- Douglas, K. M., Cichočka, A., & Sutton, R. M. (2020). Motivations, Emotions and Belief in Conspiracy Theories. In M. Butter & P. Knight (Eds.), *Routledge Handbook of Conspiracy Theories* (1st ed., pp. 181–191). Routledge. https://doi.org/10.4324/9780429452734-2_3
- Enderton, H. B. (2001). *A mathematical introduction to logic* (2nd ed). Harcourt/Academic Press.
- Ericson, J. M., Murphy, J. J., & Zeuschner, R. F. (2003). *The debater's guide* (3rd ed). Southern Illinois University Press.
- Fasce, A., & Picó, A. (2019). Conceptual foundations and validation of the Pseudoscientific Belief Scale. *Applied Cognitive Psychology*, *33*(4), 617–628. <https://doi.org/10.1002/acp.3501>
- Festinger, L. (1957). *A theory of cognitive dissonance*. (pp. xi, 291). Stanford University Press.
- Festinger, L. (1962). Cognitive Dissonance. *Scientific American*, *207*(4), 93–106. <https://doi.org/10.1038/scientificamerican1062-93>
- Festinger, L., & Carlsmith, J. M. (1959). Cognitive consequences of forced compliance. *The Journal of Abnormal and Social Psychology*, *58*(2), 203–210. <https://doi.org/10.1037/h0041593>
- Fonseca, R., Blascovich, J., & Garcia-Marques, T. (2014). Challenge and threat motivation: Effects on superficial and elaborative information processing. *Frontiers in Psychology*, *5*. <https://doi.org/10.3389/fpsyg.2014.01170>
- Gawronski, B. (2012). Back to the Future of Dissonance Theory: Cognitive Consistency as a Core Motive. *Social Cognition*, *30*(6), 652–668. <https://doi.org/10.1521/soco.2012.30.6.652>
- Gershman, S. J. (2019). How to never be wrong. *Psychonomic Bulletin & Review*, *26*(1), 13–28. <https://doi.org/10.3758/s13423-018-1488-8>

- Grossmann, I., Eibach, R. P., Koyama, J., & Sahi, Q. B. (2020). Folk standards of sound judgment: Rationality Versus Reasonableness. *Science Advances*, 6(2), eaaz0289. <https://doi.org/10.1126/sciadv.aaz0289>
- Harmon-Jones, E. (Ed.). (2019). *Cognitive dissonance: Reexamining a pivotal theory in psychology (2nd ed.)*. American Psychological Association. <https://doi.org/10.1037/0000135-000>
- Harmon-Jones, E., & Mills, J. (2019). An introduction to cognitive dissonance theory and an overview of current perspectives on the theory. In E. Harmon-Jones (Ed.), *Cognitive dissonance: Reexamining a pivotal theory in psychology (2nd ed.)*. (pp. 3–24). American Psychological Association. <https://doi.org/10.1037/0000135-001>
- Heider, F. (1946). Attitudes and Cognitive Organization. *The Journal of Psychology*, 21(1), 107–112. <https://doi.org/10.1080/00223980.1946.9917275>
- Imhoff, R., Dieterle, L., & Lamberty, P. (2021). Resolving the Puzzle of Conspiracy Worldview and Political Activism: Belief in Secret Plots Decreases Normative but Increases Nonnormative Political Engagement. *Social Psychological and Personality Science*, 12(1), 71–79. <https://doi.org/10.1177/1948550619896491>
- Irwin, H. J., Dagnall, N., & Drinkwater, K. (2015). Belief Inconsistency in Conspiracy Theorists. *Comprehensive Psychology*, 4, 17.CP.4.19. <https://doi.org/10.2466/17.CP.4.19>
- Irwin, H. J., Drinkwater, K., & Dagnall, N. (2015). The role of doublethink and other coping processes in paranormal and related beliefs. *Journal of the Society for Psychical Research*, 79(919[2]), 80–97.
- Isler, O., & Yilmaz, O. (2022). How to activate intuitive and reflective thinking in behavior research? A comprehensive examination of experimental techniques. *Behavior Research Methods*, 55(7), 3679–3698. <https://doi.org/10.3758/s13428-022-01984-4>
- Johnson-Laird, P. N., Girotto, V., & Legrenzi, P. (2004). Reasoning From Inconsistency to Consistency. *Psychological Review*, 111(3), 640–661. <https://doi.org/10.1037/0033-295X.111.3.640>
- Jolley, D., Marques, M. D., & Cookson, D. (2022). Shining a spotlight on the dangerous consequences of conspiracy theories. *Current Opinion in Psychology*, 47, 101363. <https://doi.org/10.1016/j.copsy.2022.101363>
- Jovchelovitch, S. (2008). The Rehabilitation of Common Sense: Social Representations, Science and Cognitive Polyphasia. *Journal for the Theory of Social Behaviour*, 38(4), 431–448. <https://doi.org/10.1111/j.1468-5914.2008.00378.x>
- Jovchelovitch, S., & Gervais, M.-C. (1999). Social representations of health and illness: The case of the Chinese community in England. *Journal of Community & Applied Social Psychology*, 9(4), 247–260. [https://doi.org/10.1002/\(SICI\)1099-1298\(199907/08\)9:4<247::AID-CASP500>3.0.CO;2-E](https://doi.org/10.1002/(SICI)1099-1298(199907/08)9:4<247::AID-CASP500>3.0.CO;2-E)
- Jovchelovitch, S., & Priego-Hernández, J. (2015). Cognitive polyphasia, knowledge encounters and public spheres. In G. Sammut, E. Andreouli, G. Gaskell, & J. Valsiner (Eds.), *The Cambridge Handbook of Social Representations* (pp. 163–178). Cambridge University Press. <https://doi.org/10.1017/CBO9781107323650.014>
- Khemlani, S. S., & Johnson-Laird, P. N. (2012). Hidden conflicts: Explanations make inconsistencies harder to detect. *Acta Psychologica*, 139(3), 486–491. <https://doi.org/10.1016/j.actpsy.2012.01.010>
- Klenk, V. (2008). *Understanding symbolic logic* (5th ed). Pearson Prentice Hall.
- Knežević, G., Petrović, M. B., Ninković, M., Zupan, Z., Lukić, P., Purić, D., Živanović, M., Teovanović, P., Stanković, S., & Žeželj, I. (2024). Lifetime prevalence of questionable health behaviors and their psychological roots: A preregistered nationally representative survey. *PLOS ONE*, 19(11), e0313173. <https://doi.org/10.1371/journal.pone.0313173>

- Kruglanski, A. W., Jasko, K., Milyavsky, M., Chernikova, M., Webber, D., Pierro, A., & di Santo, D. (2018). Cognitive Consistency Theory in Social Psychology: A Paradigm Reconsidered. *Psychological Inquiry*, 29(2), 45–59. <https://doi.org/10.1080/1047840X.2018.1480619>
- Lazarević, L. B., Knežević, G., Purić, D., Teovanović, P., Petrović, M. B., Ninković, M., Živanović, M., Stanković, S., Branković, M., Lukić, P., Opačić, G., & Žeželj, I. (2023). Tracking variations in daily questionable health behaviors and their psychological roots: A preregistered experience sampling study. *Scientific Reports*, 13(1), 14058. <https://doi.org/10.1038/s41598-023-41243-w>
- Lewandowsky, S., Cook, J., & Lloyd, E. (2018). The ‘Alice in Wonderland’ mechanics of the rejection of (climate) science: Simulating coherence by conspiracism. *Synthese*, 195(1), 175–196. <https://doi.org/10.1007/s11229-016-1198-6>
- Lindeman, M., Svedholm-Häkkinen, A. M., & Lipsanen, J. (2015). Ontological confusions but not mentalizing abilities predict religious belief, paranormal belief, and belief in supernatural purpose. *Cognition*, 134, 63–76. <https://doi.org/10.1016/j.cognition.2014.09.008>
- Lukić, P., Žeželj, I., & Stanković, B. (2019). How (ir)rational is it to believe in contradictory conspiracy theories? *Europe’s Journal of Psychology*, 15(1), 94–107. <https://doi.org/10.5964/ejop.v15i1.1690>
- Majima, Y. (2015). Belief in Pseudoscience, Cognitive Style and Science Literacy. *Applied Cognitive Psychology*, 29(4), 552–559. <https://doi.org/10.1002/acp.3136>
- Martinez, R. (2018). Bridging cognitive polyphasia and cognitive dissonance: The role of individual differences in the tolerance and negotiation of discrepant cognitions. *Papers on Social Representations*, 3–1.
- Miani, A., & Lewandowsky, S. (2024). *Still Very Much Dead and Alive: Re-reconsidering Belief in Contradictory Conspiracy Theories*. <https://doi.org/10.31219/osf.io/t6a54>
- Miller, J. M. (2020). Do COVID-19 Conspiracy Theory Beliefs Form a Monological Belief System? *Canadian Journal of Political Science*, 53(2), 319–326. <https://doi.org/10.1017/S0008423920000517>
- Newton, C., Feeney, J., & Pennycook, G. (2024). On the Disposition to Think Analytically: Four Distinct Intuitive-Analytic Thinking Styles. *Personality and Social Psychology Bulletin*, 50(6), 906–923. <https://doi.org/10.1177/01461672231154886>
- Pennycook, G., Cheyne, J., Barr, N., Koehler, D., & Fugelsang, J. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making*, 10, 549–563.
- Petrović, M., Branković, M., Damjanović, M., Draginić, K., Sullman, M., & Zezelj, I. (2024). *Universal threads: Shared sociopolitical roots and consequences of extrasensory perception and pseudoscientific beliefs*. <https://doi.org/10.31234/osf.io/a2xwj>
- Petrović, M. B., & Žeželj, I. (2022). Thinking Inconsistently: Development and Validation of an Instrument for Assessing Proneness to Doublethink. *European Journal of Psychological Assessment*, 38(6), 463–475. <https://doi.org/10.1027/1015-5759/a000645>
- Pew Research Center. (2017). *Vast Majority of Americans Say Benefits of Childhood Vaccines Outweigh Risks*. https://www.pewresearch.org/internet/wp-content/uploads/sites/9/2017/02/PS_2017.02.02_Vaccines_FINAL.pdf
- Priest, G. (2006). *In contradiction: A study of the transconsistent* (Expanded ed). Clarendon Press ; Oxford University Press.
- Purić, D., Petrović, M. B., Živanović, M., Lukić, P., Zupan, Z., Branković, M., Ninković, M., Lazarević, L. B., Stanković, S., & Žeželj, I. (2023). Development of a novel instrument for assessing intentional non-adherence to official medical recommendations (iNAR-12): A sequential mixed-methods study in Serbia. *BMJ Open*, 13(6), e069978. <https://doi.org/10.1136/bmjopen-2022-069978>
- Purić, D., Živanović, M., Petrović, M. B., Lukić, P., Knežević, G., Teovanović, P., Ninković, M., Lazić, A., Opačić, G., Branković, M., Lazarević, L. B., & Žeželj, I. (2025). Something Old,

- Something New, Something Borrowed, Something Green: How Different Domains of Traditional, Alternative, and Complementary Medicine Use Are Rooted in an Irrational Mindset. *Collabra: Psychology*, 11(1), 129475. <https://doi.org/10.1525/collabra.129475>
- Rizeq, J., Flora, D. B., & Toplak, M. E. (2020). An examination of the underlying dimensional structure of three domains of contaminated mindware: Paranormal beliefs, conspiracy beliefs, and anti-science attitudes. *Thinking & Reasoning*, 1–25. <https://doi.org/10.1080/13546783.2020.1759688>
- Schwind, N., Konieczny, S., & Pérez, R. P. (2022). On Paraconsistent Belief Revision in LP. *Proceedings of the AAI Conference on Artificial Intelligence*, 36(5), Article 5. <https://doi.org/10.1609/aaai.v36i5.20532>
- Sloman, S., & Fernbach, P. (2017). *The knowledge illusion: Why we never think alone*. Riverhead books.
- Sommer, J., Musolino, J., & Hemmer, P. (2023). A hobgoblin of large minds: Troubles with consistency in belief. *WIREs Cognitive Science*, 14(4), e1639. <https://doi.org/10.1002/wcs.1639>
- Šrol, J. (2022). Individual differences in epistemically suspect beliefs: The role of analytic thinking and susceptibility to cognitive biases. *Thinking & Reasoning*, 28(1), 125–162. <https://doi.org/10.1080/13546783.2021.1938220>
- Svedholm, A. M., & Lindeman, M. (2013). The separate roles of the reflective mind and involuntary inhibitory control in gatekeeping paranormal beliefs and the underlying intuitive confusions. *British Journal of Psychology*, 104(3), 303–319. <https://doi.org/10.1111/j.2044-8295.2012.02118.x>
- Tangkiatkumjai, M., Boardman, H., & Walker, D.-M. (2020). Potential factors that influence usage of complementary and alternative medicine worldwide: A systematic review. *BMC Complementary Medicine and Therapies*, 20(1), 363. <https://doi.org/10.1186/s12906-020-03157-2>
- Teovanović, P., Purić, D., Živanović, M., Lukić, P., Branković, M., Stanković, S., Knežević, G., Lazarević, B. L., & Žeželj, I. (2024). The role of cognitive biases in shaping irrational beliefs: A multi-Study Investigation. *Thinking & Reasoning*, 1–44. <https://doi.org/10.1080/13546783.2024.2421367>
- Većkalov, B., Gligorić, V., & Petrović, M. B. (2024). No evidence that priming analytic thinking reduces belief in conspiracy theories: A Registered Report of high-powered direct replications of Study 2 and Study 4 from. *Journal of Experimental Social Psychology*, 110, 104549. <https://doi.org/10.1016/j.jesp.2023.104549>
- Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and Alive: Beliefs in Contradictory Conspiracy Theories. *Social Psychological and Personality Science*, 3(6), 767–773. <https://doi.org/10.1177/1948550611434786>
- Yelbuz, B. E., Madan, E., & Alper, S. (2022). Reflective thinking predicts lower conspiracy beliefs: A meta-analysis. *Judgment and Decision Making*, 17(4), 720–744. <https://doi.org/10.1017/S1930297500008913>
- Žeželj, I., & Lazarević, L. B. (2019). Irrational beliefs. *Europe's Journal of Psychology*, 15(1), 1–7. <https://doi.org/10.5964/ejop.v15i1.1903>

Chapter 2


Paper 1 | Exploring the mechanisms that allow incompatible beliefs to coexist in the cognitive system: how doublethink relates to thinking styles and syndromes of irrational beliefs

This is the accepted, peer-reviewed version of the paper. Please cite as:

Petrović, M. B., & Žeželj, I. (2024). Exploring the Mechanisms that Allow Incompatible Beliefs to Coexist in the Cognitive System. *Psychological Reports*, 00332941241280870.

<https://doi.org/10.1177/00332941241280870> (Published online 2024)

Exploring the Mechanisms that Allow Incompatible Beliefs to Coexist in the Cognitive System

Psychological Reports
2024, Vol. 0(0) 1–23
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DOI: 10.1177/00332941241280870
journals.sagepub.com/home/prx


Marija B. Petrović  and **Iris Žeželj** 

LIRA lab, Faculty of Philosophy, University of Belgrade, Belgrade, Serbia

Department of Psychology, Faculty of Philosophy, University of Belgrade, Belgrade, Serbia

Abstract

Despite assumptions that people strive for consistency between their beliefs, endorsement of mutually incompatible ones is not rare - a tendency we have previously labelled doublethink, by borrowing from Orwell. In an attempt to understand the nature of doublethink and the underlying mechanism that enables incompatible beliefs to coexist, we conducted two preregistered studies (total $N = 691$). To do so, in Study 1, we first explored how doublethink relates to (1) thinking styles (rational/intuitive, actively open-minded thinking, and need for cognitive closure), (2) a set of irrational beliefs (magical health, conspiratorial, superstitious, and paranormal beliefs) and (3) its predictiveness for questionable health practices (non-adherence to medical recommendations and use of traditional, complementary and alternative medicine). We then additionally expanded the set of health behaviors in Study 2, and related doublethink to trust in two epistemic authorities - science and the wisdom of the common man. Finally, in both studies, we explored whether those prone to inconsistent beliefs are also more likely to simultaneously rely on conventional and alternative medicine, despite their apparent incompatibility. While doublethink was positively related to need for cognitive closure and different irrational beliefs that easily incorporate contradictions, as well as negatively to actively open-minded thinking, we did not find it to be predictive of the use of non-evidence-based medicine nor of its simultaneous use

Corresponding Author:

Marija Petrović, Department of Psychology, Faculty of Philosophy, University of Belgrade, Čika Ljubina 18-20, Belgrade 11000, Serbia.

Email: marija.petrovic@f.bg.ac.rs

Data Availability Statement included at the end of the article

Conclusions

In two highly powered preregistered studies we observed robust relationships between a relatively novel concept of doublethink and superficial information processing style, as well as a set of content-varied irrational beliefs - all in line with previous research on the topic (Petrović & Žeželj, 2022, 2023). We developed a way to meaningfully measure individual differences in endorsement of incompatible beliefs, find a non-trivial portion of the population who score relatively high on it, and offer evidence for it to be considered a feature of a specific mindset. Having in mind the consistency paradigm that was pervasive in psychology in the previous period, this should be taken as a signal that doublethink should be further researched and understood better.

Acknowledgment

This work is a part of Marija Petrović's PhD thesis entitled "Consistently inconsistent: Predictivity and validity of doublethink" at the University of Belgrade, supervised by Dr Iris Žeželj.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia [451-03-47/2023-01/200163].

Ethical Statement

Ethical Approval

The studies were approved by the Institutional Review Board at the Department of Psychology, Faculty of Philosophy, University of Belgrade, Serbia – Protocol #2022-77; Protocol #2023-006.

ORCID iDs

Marija B. Petrović  <https://orcid.org/0000-0001-6422-3957>

Iris Žeželj  <https://orcid.org/0000-0002-9527-1406>

Data availability statement

The data that support the findings of this study are openly available on the Open Science Framework at: <https://osf.io/udth2/>

Exploring the mechanisms that allow incompatible beliefs to coexist in the cognitive system: how doublethink relates to thinking styles and syndromes of irrational beliefs

Marija B. Petrović^{a,b}, & Iris Žeželj^{a,b}

^aUniversity of Belgrade, Faculty of Philosophy, LIRA lab

^bUniversity of Belgrade, Faculty of Philosophy, Department of Psychology

Author Note

Marija B. Petrović, <https://orcid.org/0000-0001-6422-3957>

Iris Žeželj, <https://orcid.org/0000-0002-9527-1406>

Corresponding author: Marija Petrović, Čika Ljubina 18-20, 11000 Belgrade, Serbia, e-mail: marija.petrovic@f.bg.ac.rs

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Abstract

Despite assumptions that people strive for consistency between their beliefs, endorsement of mutually incompatible ones is not rare - a tendency we have previously labelled doublethink, by borrowing from Orwell. In an attempt to understand the nature of doublethink and the underlying mechanism that enables incompatible beliefs to coexist, we conducted two preregistered studies (total N=691). To do so, in Study 1, we first explored how doublethink relates to (1) thinking styles (rational/intuitive, actively open-minded thinking, and need for cognitive closure), (2) a set of irrational beliefs (magical health, conspiratorial, superstitious, and paranormal beliefs) and (3) its predictiveness for questionable health practices (non-adherence to medical recommendations and use of traditional, complementary and alternative medicine). We then additionally expanded the set of health behaviors in Study 2, and related doublethink to trust in two epistemic authorities - science and the wisdom of the common man. Finally, in both studies, we explored whether those prone to inconsistent beliefs are also more likely to simultaneously rely on conventional and alternative medicine, despite their apparent incompatibility. While doublethink was positively related to need for cognitive closure and different irrational beliefs that easily incorporate contradictions, as well as negatively to actively open-minded thinking, we did not find it to be predictive of the use of non-evidence-based medicine nor of its simultaneous use with the official medicine. It seems that this novel construct can be best understood as a feature of the cognitive system that allows incompatible claims to enter it. However, once beliefs are within the system, they are compartmentalized, without any cross-referencing between them. This is further reflected in non-evidence-based beliefs persisting within the belief system, irrespective of their content.

Word count: 276

Keywords: doublethink, inconsistent beliefs, irrational beliefs, health behaviors, trust in science, thinking styles

Exploring the mechanisms that allow incompatible beliefs to coexist in the cognitive system

Despite seminal psychological works (Festinger, 1957; Heider, 1946) assuming consistency is a default state within the belief system, and inconsistency an unpleasant state urging to be resolved, there is mounting empirical evidence this might not always be the case, i.e. that a person can concurrently actively endorse mutually incompatible beliefs. There are, however, individual differences in this proneness to *doublethink* (Petrović & Žeželj, 2022; 2023), more often found in people with a more intuitive and less rational approach to information processing. Doublethink is content-independent, observed in different beliefs, regardless of their type. In other words, it is a general characteristic of the belief system. There are clusters of concrete beliefs, however, in which inconsistency is more likely to be found than in others. Within the literature, those are labeled irrational, epistemically suspect, or unwarranted beliefs (Pennycook et al., 2015; Rizeq et al., 2021), and inconsistency is sometimes even listed as one of their key features (Lewandowsky & Cook, 2020). While there is evidence that ties doublethink to this set of beliefs (Petrović & Žeželj, 2022; 2023; Lazarević et al., 2023), it is still under-researched. Understanding this link might be particularly important as irrational beliefs can have detrimental consequences, most notably leading to the use of questionable health practices (e.g. Knežević et al., 2024; Lazarević et al., 2023; Lindeman et al., 2023; Oliver & Wood, 2014; Purić et al., 2022, 2023).

Across two studies, we explored how doublethink relates to different types of irrational beliefs, how reflective it is of a certain type of superficial information processing, and whether it can be predictive of risky health behaviors.

Irrational beliefs and superficial information processing

Irrational beliefs include a wide range of beliefs that in the broadest sense do not comply with postulates of normative rationality, and contradict scientific knowledge or ontological assumptions about reality (Žeželj & Lazarević, 2019). These beliefs are more and more examined together rather than individually. Apart from their stated base conceptual similarity, all different types of irrational beliefs also tend to empirically cluster together and are highly interrelated, forming three main domains - conspiratorial, pseudoscientific and paranormal (e.g. Lobato et al., 2014; Rizeq et al., 2021; Šrol, 2022; Teovanović et al., 2024). Within such a belief system, contradictory beliefs might be particularly likely to arise. This is especially true for conspiratorial beliefs, where people are likely to endorse mutually incompatible conspiratorial narratives (Petrović & Žeželj, 2022; 2023; Lukić et al., 2019; Wood et al., 2012). Recent findings further corroborate doublethink's stable positive correlation with conspiratorial beliefs (both general and specific), but also demonstrate its relation to other types of irrational beliefs, including superstition and magical health beliefs (Knežević et al., 2024; Lazarević et al., 2023). This might be because the irrational belief system is organized in such a way that it tolerates the existence of inconsistencies (Wood, 2017).

This tolerance of contradictions might be a reflection of a more superficial information processing style (i.e. relying more on intuitive, but less on rational thinking) that is typical for people who endorse irrational beliefs (e.g., Knežević et al., 2024; Lazarević et al., 2023; Pennycook et al., 2015; Svedholm & Lindeman, 2013; Yelbuz et al., 2022). Similarly, another characteristic of such a belief system might be a strong intolerance of uncertainty reflected in the need for cognitive closure - it has previously been tied to conspiratorial thinking (Marchlewska et al., 2018), pseudoscientific claims (Van Elk, 2019), and paranormal beliefs (Wilt et al., 2022). The relation of doublethink to the need for cognitive closure is, however, less straightforward and has not been examined in the literature previously. Given that doublethink can be considered a "high entropy" (more chaotic)

thinking style, it should imply less need for cognitive closure - such a disheveled belief system suggests more tolerance of uncertainty.

While doublethink cannot be labeled as one of the irrational beliefs, given its lack of content and that it hinders on the *relation* between beliefs specifically, it does seem to fit well into the irrational mindset, allowing for very different, and even incompatible beliefs to coexist. However, which general styles of information processing shape doublethink and irrational beliefs and if it's one and the same is still left to be explored.

Detrimental health consequences of doublethink and irrational beliefs

Endorsement of irrational beliefs might be particularly problematic if we take into account its consequences, especially in the domain of health. To maintain their health or to cure themselves, people resort to various non-evidence-based practices or turn away from evidence-based ones. Previous studies (Purić et al., 2022, 2023) exploring the relation of the irrational mindset to questionable health practices have systematized these behaviors into two broad groups - (1) intentional non-adherence to medical recommendations (iNAR; e.g. avoiding checkups, self-medication, etc.) and (2) use of traditional, complementary and alternative medicine (TCAM; e.g. homeopathy, use of herbal remedies, etc.). And while the irrational mindset was an important predictor of TCAM, but not iNAR (Knežević et al., 2024; Lazarević et al., 2023; Purić et al., 2022, 2023), the relation of doublethink to these practices was less clear. One study found that doublethink was positively, albeit weakly, related to use of TCAM only (Lazarević et al., 2023), while another found no relation of doublethink to either of the two types of questionable health practices (Knežević et al., 2024). Given its relation to the irrational mindset, it might be another candidate for predicting the use of questionable health practices, and its relation to questionable health practices thus requires more scrutiny.

Study 1

Aims and hypotheses

In this first of two studies, we aimed firstly to replicate and check the robustness of previously found relations of doublethink to various irrational beliefs (Petrović & Žeželj, 2022; 2023; Knežević et al., 2024; Lazarević et al., 2023). To this end, we focused on the relations of doublethink to conspiratorial, paranormal, superstitious, and magical health beliefs, thus capturing all three main domains of irrational beliefs (conspiratorial, pseudoscientific and paranormal; Rizeq et al., 2021; Šrol, 2022). We expected that doublethink would be positively related to conspiratorial (H1a), paranormal (H1b), superstitious (H1c), and magical health beliefs (H1d), and we also expected that all irrational beliefs would be positively related to each other (H2), implying the existence of an irrational mindset.

To go even further, doublethink has been previously related to less analytical and more intuitive thinking style and actively open-minded thinking (Petrović & Žeželj, 2022; 2023) and the same is true for irrational beliefs (e.g., Pennycook et al., 2015; Svedholm & Lindeman, 2013; Yelbuz et al., 2022). We aimed to then explore how both doublethink and irrational beliefs are tied to a specific, more superficial approach to information processing, by examining their relations to actively open-minded thinking, rational and intuitive thinking styles, and the need for cognitive closure. To replicate previous findings on doublethink's relation to superficial information processing, we expected that doublethink would be positively related to intuitive thinking (H3a), but negatively to actively open-minded (H3b) and rational thinking (H3c). In this study we also focused on another specific characteristic of thinking style that has not been tied to doublethink previously - need for cognitive closure. We expected it to also be negatively related to doublethink (H3d). Similarly, as

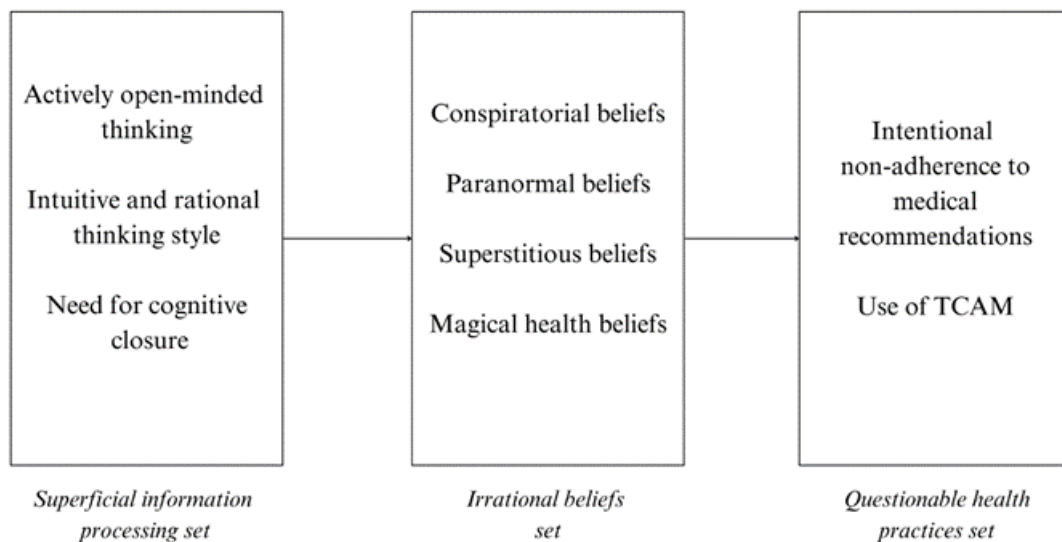
found in previous studies, we expected irrational beliefs to be positively related to intuitive thinking (H4a), but negatively to actively-open minded (H4b) and rational thinking (H4c).

In the domain of health behaviors, we expected doublethink to be related to less adherence to official medical recommendations (H5a) and more use of alternative medicine practices (H5b). We also anticipated that irrational beliefs and doublethink would contribute positively to the prediction of non-adherence to official medical recommendations (H6a) and use of alternative medicine (H6b), over and above measures of cognitive style. Finally, we expected that (H7) doublethink would be positively related to the simultaneous endorsement of official and alternative medicine.

Figure 1 shows an overview of the study.

Figure 1

Three main domains explored in the context of doublethink within the study



We preregistered all the hypotheses, analyses, and the sampling plan here - https://aspredicted.org/YBP_881

Methods

Materials

Doublethink was assessed using the Proneness to doublethink scale (Petrović & Žeželj, 2022). The scale assesses the tendency to accept mutually contradictory beliefs and consists of 11 pairs of such beliefs (e.g. *Some people are essentially irreparable* and *Every single person is capable of growth and change*). The participants assess their agreement with each item individually on a scale from 1 (completely disagree) to 4 (completely agree). The scale is presented in two separate blocks of 11 items each (one item from each pair), alongside two buffer items in each block, and with other

scales as buffers between the two blocks. The score is calculated by adding up the number of contradictory pairs where a person agrees with (marked 3 or 4 on the scale) both items in a pair. The scale shows good construct and convergent validity (e.g. Petrović & Žeželj, 2022; 2023; Lazarević et al., 2023), and is available in open access along with the scoring procedure - <https://osf.io/z7wjrl/>.

To assess the conspiratorial subdomain of epistemically suspect beliefs, we used the Conspiracy Mentality Questionnaire (Bruder et al., 2013), which assesses the general propensity to engage in conspiratorial thinking. We wanted to focus on general tendency towards conspiratorial ideation, instead of focusing on any one specific conspiracy theory to avoid any content overlap with our other measures. The scale consists of five items (e.g. *Government agencies closely monitor all citizens.*) to which participants responded using a 5-point scale (1 - *Completely disagree*; 5 - *Completely agree*). The score is calculated as the mean of answers across all items. The scale is psychometrically sound and validated cross-culturally (Imhoff et al., 2022); the Serbian version previously showed good factorial validity and reliability (Milošević-Đorđević et al., 2021).

To assess paranormal beliefs, we used two measures. First, *paranormal beliefs* were assessed via the Revised Paranormal Beliefs scale (Tobacyk, 2004), with 26 items (one reverse coded) separated into seven subscales - traditional religious beliefs, psi beliefs, witchcraft, superstition, spiritualism, extraordinary life forms and precognition (e.g. *A person's thoughts can influence the movement of a physical object.*) The participants indicated their agreement with the items on a 7-point scale (1 - *Completely disagree*; 7 - *Completely agree*). In line with previous findings (e.g., Lange et al., 2000; Houran et al., 2001) showing that a two-factor structure of the scale is more adequate, we calculated the scores for these two subscales - New Age Philosophy (11 items) and Traditional Paranormal Beliefs (5 items). According to Lange and colleagues (2000) the first subscale captures new age paranormal abilities such as astrology, while the second focuses on traditional supernatural concepts such as witchcraft. Item breakdown per subscale is available on OSF - <https://osf.io/z7wjrl/>.

As an additional measure of the paranormal subdomain of irrational beliefs, we included superstition, to make sure to tap into culturally relevant paranormal beliefs as well. *Superstition* was assessed via the Superstition scale (Žeželj et al., 2009), consisting of 20 items that measure superstitious beliefs and behaviors (e.g. *I am pleased when my palm itches, it might mean money is on the way.*). Seven items in the scale are reversely coded. The participants responded using a 5-point scale (1 - *Completely disagree*, 5 - *Completely agree*), and we calculated the score as a mean of answers on all items, given that the scale has one main factor (Žeželj et al., 2009).

To assess the domain of pseudoscientific beliefs, we included *magical health beliefs* which were measured with the 10 items from the general factor of the Magical Beliefs about Food and Health Scale (Lindeman et al., 2000). We opted for this scale because it captures well the general principles of pseudoscientific beliefs, without explicitly mentioning pseudoscientific practices. The participants indicated their agreement with the items (e.g. *An imbalance between energy currents lies behind many illnesses.*) on a 5-point scale (1 - *completely disagree*; 5 - *completely agree*). The score was calculated as a mean of all items. Both the original Finnish (e.g. Aarnio & Lindeman, 2004), as well as the English (e.g. Bryden et al., 2018) and the Serbian (e.g. Lazarević et al., 2023) versions of the scale have good reliability (alpha over .85).

Actively open-minded thinking was assessed with the eight-item version of the Actively Open-Minded Thinking Scale (Bronstein et al., 2019; Stanovich & West, 1997). We opted for this version of the scale, given that some other short operationalizations show low reliability (see Petrović & Žeželj, 2023 for details). The scale measures the tendency to use evidence to form and revise beliefs (Stanovich & West, 1997), and contains five reversely coded items. The participants answered using

a 6-point scale (1- *Completely disagree*, 6 - *Completely agree*). We calculated the score by taking the mean on all items.

Need for cognitive closure was assessed with the short version of the Need for Cognitive Closure scale (Roets & Van Hiel, 2011; Webster & Kruglanski, 1994). The scale measures the desire for certainty and consists of 15 items (e.g. *When I have made a decision, I feel relieved*). The participants indicated their agreement with the items on a 6-point scale (1- *Completely disagree*, 6 - *Completely agree*), and we calculated the score as a mean of answers on all items. The short version of the scale was empirically validated and psychometrically sound (Roets & Van Hiel, 2011).

Health behaviors. To measure how often people resort to questionable health practices, we assessed both intentional non-adherence to official medical recommendations and the use of traditional, complementary, and alternative medicine.

To assess intentional non-adherence to medical recommendations, we took four of the most frequent non-adherence behaviors reported in a previous study (e.g. *It had happened to me that I took antibiotics even though a doctor did not prescribe them to me.*; Purić et al., 2023). The participants indicated on a binary scale (0 - no, 1 - yes) if the outlined behavior has happened to them in the last 12 months. Given that the elimination of the item regarding the use of sunscreen would lead to a significant change in reliability (from $\alpha = .49$ to $\alpha = .57$), we omitted this item and were left with three items. We calculated the score as a proportion of the behaviors that have happened to the participant.

To assess TCAM use, we took two items from each of the four TCAM domains (Purić et al., 2022) - alternative medical systems (e.g. *homeopathy*), mind-body practices (e.g. *meditation*), natural product-based practices (e.g. *vitamins, minerals, and antioxidants*), and rituals/customs (e.g. *praying for health*). For each practice, the participants indicated if they had used it in the last 12 months, and we calculated the score as a proportion of used practices.

Finally, to assess *proneness to the simultaneous use of TCAM and conventional medicine*, we included the following item - *Which type of medicine do you prefer to use when you need to solve a health issue?*. The participants answered on a 7-point scale (-3 - *official medicine*, 0 - *both equally*, 3 - *Traditional, complementary and alternative medicine*). We recoded the answers to absolute values and then inversely coded them, so that higher numbers indicate a higher proneness to simultaneous use. The score then ranged from 1 to 4.

Sampling

Our final sample consisted of a total of $N = 306$ participants from Serbia, which was in line with our preregistered a priori power analysis (see the preregistration for details - https://aspredicted.org/YBP_881). A total of 476 participants from Serbia took part in the study, which was run online. They were recruited using snowballing and Facebook and Twitter ads. In line with the preregistration, we removed 170 participants who failed one of the five attention checks. Per preregistration, we checked for speeders via the relative speed index (which indicates how fast participants finish the survey compared to the median participant; RSI, Leiner, 2019). However, there were no participants with an $RSI > 2$. The sample consisted of 90.5% women, 8.5% men, while the rest of the participants chose the *other/rather would not say* option. The mean age of the participants was 48.02 ($SD = 13.02$).

Results

All data and analytical code is available on the Open Science Framework: <https://osf.io/udth2/> . Data was analyzed using R version 4.3 (R Core Team, 2024).

Table 1 details the means, standard deviations, and correlations of doublethink, irrational beliefs, and measures of information processing style.

Table 1*Means, standard deviations, reliability, and correlations of doublethink, irrational beliefs, and information processing style (Study 1)*

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1. Doublethink (0-11)	4.28	2.37	<i>0.73</i>									
2. Conspiracy mentality (1-5)	3.95	0.75	.31***	<i>0.77</i>								
3. Magical health beliefs (1-5)	2.86	0.88	.35***	.59***	<i>0.89</i>							
4. New age philosophy paranormal beliefs (1-7)	2.96	1.39	0.13	.42***	.62***	<i>0.91</i>						
5. Traditional paranormal beliefs (1-7)	2.99	1.51	.18*	.41***	.54***	.75***	<i>0.82</i>					
6. Superstition (1-5)	2.08	0.72	.24***	.28***	.40***	.55***	.55***	<i>0.87</i>				
7. Actively open-minded thinking (1-6)	4.78	0.87	-.33***	-.21**	-.26***	-.26***	-.28***	-.38***	<i>0.79</i>			
8. Need for cognitive closure (1-6)	4.11	0.78	.30***	.17*	0.1	0.02	0.1	.27***	-.30***	<i>0.84</i>		

Table 1 continued

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
9. Rational thinking style (1-5)	4.05	0.82	-0.06	-0.06	-0.06	-0.09	-.18*	-.22**	0.15	-.18*	0.75	
10. Experiential thinking style (1-5)	3.39	0.97	0.08	.25***	.31***	.34***	.28***	.22**	-0.09	-.19*	-0.02	0.77

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. The main diagonal shows reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2022) and Cronbach's alpha for all other measures)

All *p* values were adjusted for multiple observations using Holm's method.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

All of our hypotheses regarding irrational beliefs and doublethink were confirmed. As expected (H1a-d), doublethink was positively related to all irrational beliefs (except for one paranormal beliefs subscale), while all irrational beliefs were positively related to each other, in line with our prediction (H2).

Moreover, as we expected, doublethink was negatively related to actively open-minded thinking (H3b). However, contrary to our predictions (H3d), the relation of doublethink to the need for cognitive closure was positive. Doublethink was also, unexpectedly, not related to either the intuitive (H3a) or rational (H3c) thinking style.

As for irrational beliefs, they were all positively related to intuitive thinking, in line with our predictions (H4a), while as expected, negatively related to actively open-minded thinking (H4b). Rational thinking style was negatively related to only traditional paranormal and superstitious beliefs, while other correlations were not significant, thus only partially in line with H4c.

To explore how doublethink is related to health behaviors, we also examined their interrelations (Table 2).

Table 2

Means, standard deviations, and correlations of doublethink and different health behaviors - Study 1

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. Doublethink (0-11)	4.28	2.37	0.73		
2. Intentional non-adherence to medical recommendations (0-1)	0.55	0.34	0.11	0.57	
3. Use of TCAM (0-1)	0.29	0.16	-0.01	0.14	0.39
4. Preference for simultaneous use of conventional and alternative medicine (1-4)	2.16	1.35	0.04	.17*	.36***

Note. For 4., higher scores indicate more preference for simultaneous use of conventional and alternative medicine. *M* and *SD* are used to represent mean and standard deviation, respectively. The main diagonal shows the reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2022) and Cronbach's alpha for all other measures)

All *p* values were adjusted for multiple observations using Holm's method.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

As the Table 2 suggests, we found no relation of doublethink to either intentional non-adherence (H5a) or use of TCAM (H5b), which was not in line with our expectations. Similarly, we did not find a significant correlation between doublethink and preference for the simultaneous use of official and alternative medicine (H7).

It should be noted, however, that the short measures of intentional non-adherence and TCAM use had low reliability ($\alpha = .57$ and $\alpha = .39$, respectively). This is why we also explored how doublethink is related to individual non-adherence behaviors, as well as individual TCAM practices. After correcting for multiple comparisons using Holm's method, none of the correlations of doublethink to individual behaviors were significant.

To account for the poor reliability of some of the measures, we also report correlations corrected for attenuation (see Supplement S1 on OSF). As expected, this led to an increase in the magnitude of all correlations, however, the non-significant correlations remain at a level that does not reach significance. The overall pattern of results thus remains the same.

Finally, to assess the relative contribution of doublethink and irrational beliefs to the prediction of intentional non-adherence and use of TCAM when information processing style is taken into account, we ran a path analysis. We opted for this for the sake of clarity and to take into account multiple comparisons. We fit the model using the maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistic. We fit a model with intentional non-adherence and TCAM as the outcomes, and all measures of superficial information processing and irrational beliefs, as well as doublethink as predictors (Table 3).

Table 3
Path analysis with TCAM and iNAR as outcomes - Study 1

Outcome	Predictor	Estimate	Standardized estimate	<i>p</i>
iNAR	Actively open-minded thinking	-0.017	-0.042	0.526
	Need for cognitive closure	0.01	0.023	0.721
	Rational thinking style	0.019	0.045	0.443
	Experiential thinking style	0.007	0.02	0.753
	Doublethink	0.01	0.068	0.308
	Conspiracy mentality	0.011	0.024	0.738
	Magical health beliefs	-0.021	-0.054	0.518
	New age philosophy beliefs	0.005	0.018	0.856

Table 3 continued

Outcome	Predictor	Estimate	Standardized estimate	<i>p</i>
	Traditional paranormal beliefs	0.040*	.178*	0.043
	Superstition	-0.005	-0.01	0.899
TCAM				
	Actively open-minded thinking	0.015	0.078	0.153
	Need for cognitive closure	0.025	0.119	0.06
	Rational thinking style	-0.005	-0.025	0.614
	Experiential thinking style	0.003	0.015	0.781
	Doublethink	-0.011**	-.164**	0.006
	Conspiracy mentality	-0.024	-0.113	0.049
	Magical health beliefs	0.063***	.349***	<.001
	New age philosophy beliefs	0.009	0.075	0.319
	Traditional paranormal beliefs	0.018*	.167*	0.024
	Superstition	0.016	0.073	0.244

Note. Significant predictors are printed in bold.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

As Table 3 suggests and as opposed to our predictions (H5a), almost none of the predictors contributed to the prediction of intentional non-adherence, with the exception of traditional paranormal beliefs, which only marginally contributed to the prediction (standardized estimate = .178, $p = .043$). The model explained under 5% of the variance of intentional non-adherence ($R^2 = .047$).

For TCAM use (Table 3), the results were partially in line with our predictions (H5b). While none of the thinking style variables contributed significantly to prediction, irrational beliefs and doublethink did. Magical health beliefs (standardized estimate = .349, $p < .001$) and traditional paranormal beliefs (standardized estimate = .167, $p = .024$) contributed positively to the prediction, as expected. Doublethink, however, contributed negatively to the prediction (standardized estimate = -.164, $p = .006$). In total, the model explained around a total of 24% of the variance of TCAM practices' use.

Given that we preregistered a test of our hypotheses via hierarchical linear regression and that those results were fully in line with the model presented here, for the sake of brevity, we report those results in Supplement S1.

Robustness checks

Given that some of the distributions were skewed, we also reran the analyses with normalized scores. The pattern of the results remained the same (see Supplementary file S2 on the Open Science Framework project page for more information).

Study 2

Introduction

While our preliminary findings suggest that there is no relation between doublethink and questionable health behaviors, it is also possible that doublethink could be tied to the use of health practices in less direct ways. Cognitive polyphasia (Jovchelovitch & Gervais, 1999) is a concept closely related to doublethink referring to a state where contradicting explanations of the world are endorsed by the same individual. Much of the research on cognitive polyphasia has been in the health domain, where studies show that, for example, practices and beliefs from traditional medicine are combined with conventional medical knowledge, despite them often conflicting with each other (Jovchelovitch & Priego-Hernández, 2015). Thus, endorsement of contradictory beliefs might not be predictive of proneness to questionable health behaviors as such, but could potentially explain how people use different questionable health practices. For example, people can use TCAM alternatively to official medicine, simultaneously with it, or even preventively. Doublethink could then be related specifically to simultaneous use and can explain how people rely on different practices simultaneously, even when they are based on contradictory principles.

Moreover, doublethink could stoke trust in unwarranted epistemic authorities, or hinder trust in appropriate ones, much like irrational beliefs do. This could then further endorse the use of questionable health practices. One such warranted epistemic authority is science. Mistrust in science has been repeatedly tied to conspiratorial (Rutjens & Većkalov, 2022), but also to pseudoscientific (Fasce & Picó, 2019a) and paranormal beliefs (Fasce & Picó, 2019b). It has not, however, been explored alongside doublethink so far. Furthermore, during the pandemic, mistrust in science has been repeatedly tied to questionable health practices, both in the domain of non-adherence to

conventional practices and in the domain of TCAM use (Algan et al., 2021; Pagliaro et al., 2021; Žeželj et al., 2023).

Conversely, often contrasted with trust in science (Merkley & Loewen, 2021) is the so-called trust in the “wisdom of the common/ordinary man” (Žeželj et al., 2023), i.e. trust in the the common sense of an average layperson. Trust in the wisdom of the common man has also been related to epistemically suspect beliefs, in particular belief in conspiracy theories, and to questionable health practices (Žeželj et al., 2023). Still, its relation to doublethink has not been examined previously. Not only that, but despite them being contrasted in literature (e.g. this referral of trust to the ordinary people as in Oliver & Rahn, 2016 has been equated with anti-intellectualism), and their implicit incompatibility, trust in science and trust in the “wisdom of the common man” were previously shown to be unrelated in non-US samples (Žeželj et al., 2023). This means that, at least for some people, these two types of epistemic authorities are not mutually exclusive, and doublethink could again help reconcile them.

Aims and hypotheses

Given that the reliability of health behaviors was low in the previous study, in this study we focused on expanding the list of health behaviors and used the full original instruments (Purić et al., 2022, 2023) to discern better if doublethink is related to questionable health practices. We again expected that doublethink would be positively related to less adherence to official medical recommendations (H1a) and the use of alternative medicine practices (H1b). Moreover, drawing from previous findings that non-adherence to medical recommendations and use of TCAM are positively related (Purić et al., 2022, 2023), we also explored if doublethink moderates this relation - for those higher on doublethink relying on both conventional and alternative medicine might be easier. We thus expected that doublethink would moderate the relation between non-adherence to medical recommendations and use of TCAM, so that this correlation is weaker for people more prone to doublethink (H2). We also expected that doublethink would be positively related to the perception of conventional and alternative medicine as complementary (H3a), and to simultaneous reliance on conventional and alternative medicine when having to solve a health problem (H3b).

We also focused on exploring how doublethink is related to trust in two types of epistemic authorities - science and the wisdom of the common man. We expected that doublethink would be negatively related to trust in science (H4a), but positively to trust in the “wisdom of the common man” (H4b), in line with previous findings on the relation of these two types of trust to irrational beliefs (Žeželj et al., 2023). Moreover, we expected that doublethink would moderate the relation between these two types of trust, so that this relation is stronger and positive for higher scores of doublethink (H5).

We again preregistered all the hypotheses, analyses, and the sampling plan here:

https://aspredicted.org/C9X_CKC

Methods

Materials

Intentional non-adherence was assessed with the iNAR-12 questionnaire (Purić et al., 2023). The questionnaire consists of 12 items that assess lifetime intentional non-adherence to different medical recommendations (e.g. taking antibiotics without prescription, not reporting all symptoms to

a doctor), to which participants answer using a binary scale (0 - *it has never happened to me*; 1 - *it has happened to me*). The score is calculated by averaging all items.

Use of TCAM practices was assessed with the TCAM-22 questionnaire (Purić et al., 2022), which consists of 22 alternative medical practices (e.g. homeopathy, use of herbal tinctures, prayer, use of crystals). Responses are given in a binary format (0 - *I have never used this practice*, 1 - *I have used this practice or I am still using it*), and a total score is calculated by averaging all items. Both of the scales (iNAR and TCAM) were empirically derived from a larger pool of items, and are psychometrically sound and reliable (e.g. Lazarević et al., 2023; Knežević et al., 2024).

To more precisely assess the *perception of the relationship between alternative and conventional medicine* we used both an attitudinal indicator and a behavioral one.

To measure attitudes towards this relationship (attitudinal indicator), we constructed five items for this study (e.g. *For me, alternative and conventional medicine complement each other*). The participants indicated their agreement with the items on a 7-point scale (1 - *completely disagree*; 7 - *completely agree*). All items had high loadings on a single factor ($>.80$), and the scale had an excellent reliability ($\alpha = .94$), so we calculated the score by averaging answers on all five items.

To assess if participants are inclined to also use the two types of medicine simultaneously (behavioral indicator), we again asked them what type of medicine they prefer to use when they have to resolve a certain health issue. The participants responded using a 7-point scale (-3 - *conventional medicine*; 0 - *both equally*; +3 - *alternative medicine*). We recoded the answers to absolute values and then inversely coded them, so that the highest score (i.e. 3) reflected that participants were prone to simultaneously use, while lower scores indicated that they are more ready to opt for one of the two types. The score ranged from 0 to 3.

To assess *trust in epistemic authorities* we used two items (Žeželj et al., 2023), in which we asked the participants how much trust they have in (a) science and (b) the wisdom of the “common man”, when it comes to knowledge about and dealing with health problems. The participants answered using a 7-point scale (1 - *no trust at all*; 7 - *trust completely*).

Doublethink was assessed as in the previous study.

Sampling

Our final sample size, which was in line with our a priori power analysis (see preregistration for details - https://aspredicted.org/C9X_CKC), consisted of 385 participants from Serbia, collected online using snowballing and Facebook ads. As per preregistration, three attention checks were used as filters, so those that failed them were filtered out and could not continue on with the study (127 participants failed the first attention check, three the second one, and three the final one). We again checked for speeders via the relative speed index (RSI, Leiner, 2019) and removed a total of five participants that had an RSI above 2. The sample consisted of 80.5% women, 17.6% men, while the rest of the participants chose the *other/rather would not say* option. The mean age of the participants was 49.85 (SD = 11.91).

Results

All data and analytical code are available on the Open Science Framework: <https://osf.io/udth2/>. Data was again analyzed using R version 4.3 (R Core Team, 2024).

Table 4 details means, standard deviations, and correlations, as well as reliabilities for all multi-item measures on the main diagonal.

Table 4*Means, standard deviations, and correlations of all used variables - Study 2*

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. Doublethink (0-11)	4.1	2.25	0.68					
2. iNAR (0-1)	0.36	0.21	0.06	0.68				
3. TCAM (0-1)	0.37	0.17	0.01	.23***	0.79			
4. Trust in science (1-7)	5.84	1.19	0.01	-.17**	-.20***	/		
5. Trust in the wisdom of the common man (1-7)	4.34	1.51	.20***	0.11	.34***	-0.06	/	
6. Relationship between alternative and conventional medicine - attitudinal indicator (1-7)	4.65	1.79	.24***	0.09	.42***	-0.1	.38***	0.94
7. Relationship between alternative and conventional medicine - behavioral indicator (0-3)	1.08	1.21	0.1	0.14	.35***	-.22***	.23***	.51***

Note. For 6. and 7., higher scores indicate that conventional and alternative medicine are seen/used as more compatible. *M* and *SD* are used to represent mean and standard deviation, respectively. The main diagonal shows reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2021) and Cronbach's alpha for all other measures)

All *p* values were adjusted for multiple observations using Holm's method.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

While both the iNAR and TCAM use measures showed improved reliability relative to Study 1, contrary to our predictions, doublethink was not related to either iNAR (H1a) or TCAM use (H1b). Those more prone to doublethink were more likely to perceive conventional and alternative medicine as complementary (H3a), but, unexpectedly, not more prone to actually use them simultaneously when they had a health issue (H3b). We found no correlation of doublethink and trust in science (H4a), but as expected, those higher on doublethink were more likely to have trust in the wisdom of the “common man” when it came to resolving health problems (H4b). We also found that trust in science was related to more adherence to recommendations, and less use of TCAM, while trust in the wisdom of the “common man” positively contributed only to the prediction of use of TCAM.

As in Study 1, due to the lower reliability of some measures, we also report correlations corrected for attenuation in Supplement S1. As in Study 1, this increases the magnitude of the correlations, but did not change the pattern of results reported here.

Moderation analyses

To explore if doublethink moderates the relation between iNAR and use of TCAM (H3), as well as the relation between two types of trust (H5), we ran two moderation analyses using a path model with maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistic using the R package *lavaan* (Rosseel, 2012). Contrary to our prediction, doublethink was not a significant moderator of either of those two relationships.

There was a significant main effect found between iNAR and TCAM ($beta = .235, p < .001$), however, there was no significant main effect of doublethink on TCAM use ($beta = -.002, p = .969$). There was also no moderating effect of doublethink ($beta = -.008, p = .864$).

Similarly, there was no moderating effect of doublethink on the relation between trust in science and the wisdom of the “common man” ($beta = -.019, p = .743$). We also did not find a main effect of trust in science ($beta = -.063, p = .273$), while there was a significant main effect of doublethink ($beta = 0.204, p < .001$).

Robustness checks

As in Study 1, we reran the analyses with normalized scores and without outliers as a robustness check. The pattern of the results remained largely the same (see Supplementary file S3 on OSF for more information).

Discussion

Across two studies, we explored how doublethink relates to superficial information processing and irrational beliefs, and whether it is predictive of questionable health practices and reflected in trust in different epistemic authorities.

Our results show that, while doublethink is not related to trust in science, it is related to higher trust in the “wisdom of the common man”. This type of epistemic authority is often referred to as anti-intellectualism and is implicitly, but also often explicitly contrasted with trust in experts or even used as a proxy for distrust in experts (e.g., Merkley, 2020; Merkley & Loewen, 2021; Oliver & Rahn, 2016). However, despite this tendency to equate them in the literature, we again found no correlation between the trust in science and in the wisdom of the common man in a Serbian sample (Žeželj et al., 2023). We also find that this trust in the common man is related to doublethink. This implies that, at

least in our non-Western samples, trust in the ordinary man is not incompatible with trust in experts, or that incompatibility can be overcome within the belief system.

We have now also consistently observed the expected positive relations between doublethink and endorsement of irrational beliefs, very different in content at that. This is in line with our previous findings on the positive link between doublethink and conspiratorial beliefs (Petrović & Žeželj, 2022; 2023), and more recent findings on its positive relation to other types of irrational beliefs as well (Lazarević et al., 2023). Moreover, we again found that those prone to doublethink are also more likely to be more actively open-minded in their thinking, in line with previous findings (Petrović & Žeželj, 2023). The pattern of doublethink's relation to the set of irrational beliefs and the set of thinking styles does not allow us to firmly situate it within either of those blocks. On one hand, doublethink implies a departure from principles of normative reasoning - one of the defining features of irrational beliefs. However, irrational beliefs are content-specific, and differ from each other specifically in that content, while doublethink is largely content-independent, and can arise in any type of belief as long as they are incompatible. On the other hand, doublethink can be considered a thinking style that implies a higher tolerance of contradictory beliefs (Petrović & Žeželj, 2022). In contrast to other thinking styles which are assessed through self-report and thus represent a measure of a preferred approach to information processing, doublethink is a direct measure of the number of contradictory beliefs a person adopts. In our view, this cannot be dismissed as only a method difference, but signals an important difference in the nature of these constructs.

Having in mind the nature of doublethink, we expected that such a belief system should be made possible by a higher tolerance of uncertainty, i.e. lower need for cognitive closure. The relation we observed was, nevertheless, positive. This could be due to the fact that this belief system is permeable only upon entry, when beliefs are indiscriminately adopted. Once adopted, however, beliefs may rarely be cross-referenced and subjected to scrutiny which makes them harder to correct or change altogether, which is typical for those high in need for cognitive closure (Webster & Kruglanski, 1994). It could also be that drawing from a need for certainty and cognitive closure, people adopt mutually exclusive beliefs to “cover their bases as wide as possible” and represent all possible outcomes within their belief system.

Finally, despite our expectations, we did not find that doublethink is predictive of the use of questionable health practices. Those prone to doublethink were, however, more likely to see conventional and alternative medicine as mutually compatible, but not to also simultaneously use them. This would suggest that while doublethink is related to beliefs on alternative and conventional medicine, this relation does not necessarily transfer to behaviors as well. Moreover, while out of the scope of this study, the pattern of results suggests the possibility of doublethink contributing to TCAM use indirectly, by stoking trust in inadequate epistemic authorities and especially irrational beliefs, given its stable relation to them.

Limitations and future directions

While we aimed to cover a wider range of irrational beliefs, we certainly cannot claim it is representative of the whole set. Future studies could, for example, focus on examining whether doublethink is related to pseudoscientific beliefs specifically, as they are one of the three key domains of irrational beliefs (Rizeq et al., 2021; Šrol, 2022).

Our studies used a correlational design, which did not allow us to make assumptions about the direction of relations between the constructs. To learn more about that, one could try to experimentally manipulate doublethink and observe the outcomes of the potential change. This could

be done through, for example, highlighting the cognitive dissonance in people's own beliefs, and then testing if this subsequently reduces irrational beliefs.

In these studies we tested the relationship between doublethink and basic thinking styles, while future ones could relate it to basic personality dispositions, especially focusing on Openness to experience.

Since it was out of the scope of this study, we did not check the participants' overall health status. It could be that those with poorer overall health or those currently suffering from medical illnesses have more opportunities to use both conventional medicine and TCAM. Future studies could thus examine whether those groups in particular are more likely to simultaneously rely on both, and whether proneness to doublethink is higher for those who do.

Finally, in this paper, we examined trust in two epistemic authorities independently of each other and found that doublethink only relates to the trust in the wisdom of the common man. It could be informative to look into whether there is a trade-off between these two types of trust by directly contrasting them, similarly to how we contrasted alternative and conventional medicine within a single question. This would allow us to see if people choose science over the wisdom of the common man or vice versa, or whether they rely on both epistemic authorities simultaneously.

Conclusions

In two highly powered preregistered studies we observed robust relationships between a relatively novel concept of doublethink and superficial information processing style, as well as a set of content-varied irrational beliefs - all in line with previous research on the topic (Petrović & Žeželj, 2022; 2023). We developed a way to meaningfully measure individual differences in endorsement of incompatible beliefs, find a non-trivial portion of the population who score relatively high on it, and offer evidence for it to be considered a feature of a specific mindset. Having in mind the consistency paradigm that was pervasive in psychology in the previous period, this should be taken as a signal that doublethink should be further researched and understood better.

Chapter 2 References

- Aarnio, K., & Lindeman, M. (2004). Magical food and health beliefs: A portrait of believers and functions of the beliefs. *Appetite*, 43(1), 65–74. <https://doi.org/10.1016/j.appet.2004.03.002>
- Algan, Y., Cohen, D., Davoine, E., Foucault, M., & Stantcheva, S. (2021). Trust in scientists in times of pandemic: Panel evidence from 12 countries. *Proceedings of the National Academy of Sciences*, 118(40), e2108576118. <https://doi.org/10.1073/pnas.2108576118><https://doi.org/10.1371/journal.pone.0279122>
- Bronstein, M. V., Pennycook, G., Bear, A., Rand, D. G., & Cannon, T. D. (2019). Belief in fake news is associated with delusionality, dogmatism, religious fundamentalism, and reduced analytic thinking. *Journal of Applied Research in Memory and Cognition*, 8(1), 108–117. <https://doi.org/10.1037/h0101832>
- Bruder, M., Haffke, P., Neave, N., Nouripanah, N., & Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: Conspiracy Mentality Questionnaire. *Frontiers in Psychology*, 4. <https://doi.org/10.3389/fpsyg.2013.00225>
- Bryden, G. M., Browne, M., Rockloff, M., & Unsworth, C. (2018). Anti-vaccination and pro-CAM attitudes both reflect magical beliefs about health. *Vaccine*, 36(9), 1227–1234. <https://doi.org/10.1016/j.vaccine.2017.12.068>
- Fasce, A., & Picó, A. (2019a). Conceptual foundations and validation of the Pseudoscientific Belief Scale. *Applied Cognitive Psychology*, 33(4), 617–628. <https://doi.org/10.1002/acp.3501>
- Fasce, A., & Picó, A. (2019b). Science as a Vaccine: The Relation between Scientific Literacy and Unwarranted Beliefs. *Science & Education*, 28(1–2), 109–125. <https://doi.org/10.1007/s11191-018-00022-0>
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford University Press.
- Heider, F. (1946). Attitudes and Cognitive Organization. *The Journal of Psychology*, 21(1), 107–112. <https://doi.org/10.1080/00223980.1946.9917275>
- Houran, J., Irwin, H. J., & Lange, R. (2001). Clinical relevance of the two-factor rasch version of the Revised Paranormal Belief Scale. *Personality and Individual Differences*, 31(3), 371–382. [https://doi.org/10.1016/S0191-8869\(00\)00143-4](https://doi.org/10.1016/S0191-8869(00)00143-4)
- Imhoff, R., Zimmer, F., Klein, O., António, J. H. C., Babinska, M., Bangerter, A., Bilewicz, M., Blanuša, N., Bovan, K., Bužarovska, R., Cichocka, A., Delouvée, S., Douglas, K. M., Dyrendal, A., Etienne, T., Gjoneska, B., Graf, S., Gualda, E., Hirschberger, G., ... Van Prooijen, J.-W. (2022). Conspiracy mentality and political orientation across 26 countries. *Nature Human Behaviour*, 6(3), 392–403. <https://doi.org/10.1038/s41562-021-01258-7>
- Jovchelovitch, S., & Gervais, M.-C. (1999). Social representations of health and illness: The case of the Chinese community in England. *Journal of Community & Applied Social Psychology*, 9(4), 247–260. [https://doi.org/10.1002/\(SICI\)1099-1298\(199907/08\)9:4<247::AID-CASP500>3.0.CO;2-E](https://doi.org/10.1002/(SICI)1099-1298(199907/08)9:4<247::AID-CASP500>3.0.CO;2-E)
- Jovchelovitch, S., & Priego-Hernández, J. (2015). Cognitive polyphasia, knowledge encounters and public spheres. In G. Sammut, E. Andreouli, G. Gaskell, & J. Valsiner (Eds.), *The*

Cambridge Handbook of Social Representations (pp. 163–178). Cambridge University Press. <https://doi.org/10.1017/CBO9781107323650.014>

- Knežević, G., Petrović, M., Ninković, M., Zupan, Z., Purić, D., Lukić, P., Živanović, M., Teovanović, P., Stanković, S., & Žeželj, I. (2024). *Lifetime prevalence of questionable health behaviors and their psychological roots: A preregistered nationally representative survey* [Preprint]. PsyArXiv. <https://doi.org/10.31234/osf.io/zf4q7>
- Lange, R., Irwin, H. J., & Houran, J. (2000). Top-down purification of Tobacyk's Revised Paranormal Belief Scale. *Personality and Individual Differences*, 29(1), 131–156. [https://doi.org/10.1016/S0191-8869\(99\)00183-X](https://doi.org/10.1016/S0191-8869(99)00183-X)
- Lazarević, L. B., Knežević, G., Purić, D., Teovanović, P., Petrović, M. B., Ninković, M., Živanović, M., Stanković, S., Branković, M., Lukić, P., Opačić, G., & Žeželj, I. (2023). Tracking variations in daily questionable health behaviors and their psychological roots: A preregistered experience sampling study. *Scientific Reports*, 13(1), 14058. <https://doi.org/10.1038/s41598-023-41243-w>
- Leiner, D. J. (2019). Too Fast, too Straight, too Weird: Non-Reactive Indicators for Meaningless Data in Internet Surveys. *Survey Research Methods*, 13(3), Article 3. <https://doi.org/10.18148/srm/2019.v13i3.7403>
- Lewandowsky, S., & Cook, J. (2020). *The Conspiracy Theory Handbook*. <http://sks.to/conspiracy>
- Lindeman, M., Keskivaara, P., & Roschier, M. (2000). Assessment of Magical Beliefs about Food and Health. *Journal of Health Psychology*, 5(2), 195–209. <https://doi.org/10.1177/135910530000500210>
- Lindeman, M., Svedholm-Häkkinen, A. M., & Riekkari, T. J. J. (2023). Searching for the cognitive basis of anti-vaccination attitudes. *Thinking & Reasoning*, 29(1), 111–136. <https://doi.org/10.1080/13546783.2022.2046158>
- Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the Relationship Between Conspiracy Theories, Paranormal Beliefs, and Pseudoscience Acceptance Among a University Population: Relationship between unwarranted beliefs. *Applied Cognitive Psychology*, 28(5), 617–625. <https://doi.org/10.1002/acp.3042>
- Lukić, P., Žeželj, I., & Stanković, B. (2019). How (ir)rational is it to believe in contradictory conspiracy theories? *Europe's Journal of Psychology*, 15(1), 94–107. <https://doi.org/10.5964/ejop.v15i1.1690>
- Marchlewska, M., Cichočka, A., & Kossowska, M. (2018). Addicted to answers: Need for cognitive closure and the endorsement of conspiracy beliefs. *European Journal of Social Psychology*, 48(2), 109–117. <https://doi.org/10.1002/ejsp.2308>
- Merkley, E. (2020). Anti-Intellectualism, Populism, and Motivated Resistance to Expert Consensus. *Public Opinion Quarterly*, 84(1), 24–48. <https://doi.org/10.1093/poq/nfz053>
- Merkley, E., & Loewen, P. J. (2021). Anti-intellectualism and the mass public's response to the COVID-19 pandemic. *Nature Human Behaviour*, 5(6), 706–715. <https://doi.org/10.1038/s41562-021-01112-w>

- Milošević-Dorđević, J., Žeželj, I., & Đurić, Ž. (2021). Beyond general political attitudes: Conspiracy mentality as a global belief system predicts endorsement of international and local conspiracy theories. *Journal of Social and Political Psychology*, 9(1), 144–158. <https://doi.org/10.5964/jspp.5609>
- Oliver, J. E., & Rahn, W. M. (2016). Rise of the Trumpenvolk: Populism in the 2016 Election. *The ANNALS of the American Academy of Political and Social Science*, 667(1), 189–206. <https://doi.org/10.1177/0002716216662639>
- Oliver, J. E., & Wood, T. (2014). Medical conspiracy theories and health behaviors in the United States. *JAMA Internal Medicine*, 174(5), 817. <https://doi.org/10.1001/jamainternmed.2014.190>
- Pagliaro, S., Sacchi, S., Pacilli, M. G., Brambilla, M., Lionetti, F., Bettache, K., Bianchi, M., Biella, M., Bonnot, V., Boza, M., Butera, F., Ceylan-Batur, S., Chong, K., Chopova, T., Crimston, C. R., Álvarez, B., Cuadrado, I., Ellemers, N., Formanowicz, M., ... Zubietta, E. (2021). Trust predicts COVID-19 prescribed and discretionary behavioral intentions in 23 countries. *PLOS ONE*, 16(3), e0248334. <https://doi.org/10.1371/journal.pone.0248334>
- Pennycook, G., Cheyne, J., Barr, N., Koehler, D., & Fugelsang, J. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making*, 10, 549–563.
- Petrović, M. B., & Žeželj, I. (2022). Thinking inconsistently: Development and validation of an instrument for assessing proneness to doublethink. *European Journal of Psychological Assessment*, 38(6), 463–475. <https://doi.org/10.1027/1015-5759/a000645>
- Petrović, M., & Žeželj, I. (2023). Both a bioweapon and a hoax: The curious case of contradictory conspiracy theories about COVID-19. *Thinking & Reasoning*, 29(4), 456–487. <https://doi.org/10.1080/13546783.2022.2088618>
- Purić, D., Petrović, M. B., Živanović, M., Lukić, P., Zupan, Z., Branković, M., Ninković, M., Lazarević, L. B., Stanković, S., & Žeželj, I. (2023). Development of a novel instrument for assessing intentional non-adherence to official medical recommendations (iNAR-12): A sequential mixed-methods study in Serbia. *BMJ Open*, 13(6), e069978. <https://doi.org/10.1136/bmjopen-2022-069978>
- Purić, D., Živanović, M., Petrović, M., Lukic, P., Knezevic, G., Teovanovic, P., Ninković, M., Lazić, A., Opacic, G., Branković, M., Lazarevic, L. B., & Zezelj, I. (2022). *Something old, something new, something borrowed, something green: How different domains of traditional, alternative, and complementary medicine use are rooted in an irrational mindset* [Preprint]. PsyArXiv. <https://doi.org/10.31234/osf.io/agp5y>
- R Core Team. (2024). *R: A language and environment for statistical computing*. [Computer software]. <https://www.r-project.org/>
- Rizeq, J., Flora, D. B., & Toplak, M. E. (2021). An examination of the underlying dimensional structure of three domains of contaminated mindware: Paranormal beliefs, conspiracy beliefs, and anti-science attitudes. *Thinking & Reasoning*, 27(2), 187–211. <https://doi.org/10.1080/13546783.2020.1759688>

- Roets, A., & Van Hiel, A. (2011). Item selection and validation of a brief, 15-item version of the Need for Closure Scale. *Personality and Individual Differences, 50*(1), 90–94. <https://doi.org/10.1016/j.paid.2010.09.004>
- Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software, 48*(2), 1–36. <https://doi.org/10.18637/jss.v048.i02>
- Rutjens, B. T., & Većkalov, B. (2022). Conspiracy beliefs and science rejection. *Current Opinion in Psychology, 46*, 101392. <https://doi.org/10.1016/j.copsy.2022.101392>
- Šrol, J. (2022). Individual differences in epistemically suspect beliefs: The role of analytic thinking and susceptibility to cognitive biases. *Thinking & Reasoning, 28*(1), 125–162. <https://doi.org/10.1080/13546783.2021.1938220>
- Stanovich, K. E., & West, R. F. (1997). Reasoning independently of prior belief and individual differences in actively open-minded thinking. *Journal of Educational Psychology, 89*(2), 342–357. <https://doi.org/10.1037/0022-0663.89.2.342>
- Svedholm, A. M., & Lindeman, M. (2013). The separate roles of the reflective mind and involuntary inhibitory control in gatekeeping paranormal beliefs and the underlying intuitive confusions. *British Journal of Psychology, 104*(3), 303–319. <https://doi.org/10.1111/j.2044-8295.2012.02118.x>
- Teovanovic, P., Purić, D., Živanović, M., Lukic, P., Branković, M., Stanković, S., Knezevic, G., Lazarevic, L. B., & Zezelj, I. (2024). *The Role of Cognitive Biases in Shaping Irrational Beliefs: A Multi-Study Investigation* [Preprint]. PsyArXiv. <https://doi.org/10.31234/osf.io/g59k4>
- Tobacyk, J. J. (2004). A Revised Paranormal Belief Scale. *International Journal of Transpersonal Studies, 23*(1), 94–98. <https://doi.org/10.24972/ijts.2004.23.1.94>
- Van Elk, M. (2019). Socio-cognitive biases are associated to belief in neuromyths and cognitive enhancement: A pre-registered study. *Personality and Individual Differences, 147*, 28–32. <https://doi.org/10.1016/j.paid.2019.04.014>
- Webster, D. M., & Kruglanski, A. W. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology, 67*(6), 1049–1062. <https://doi.org/10.1037/0022-3514.67.6.1049>
- Wilt, J., Stauner, N., May, R. W., Fincham, F. D., Pargament, K. I., & Exline, J. J. (2022). Who Engages with Supernatural Entities? An Investigation of Personality and Cognitive Style Predictors. *Imagination, Cognition and Personality, 41*(4), 373–414. <https://doi.org/10.1177/02762366211065677>
- Wood, M. J. (2017). Conspiracy suspicions as a proxy for beliefs in conspiracy theories: Implications for theory and measurement. *British Journal of Psychology, 108*(3), 507–527. <https://doi.org/10.1111/bjop.12231>
- Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and Alive: Beliefs in Contradictory Conspiracy Theories. *Social Psychological and Personality Science, 3*(6), 767–773. <https://doi.org/10.1177/1948550611434786>

- Yelbuz, B. E., Madan, E., & Alper, S. (2022). Reflective thinking predicts lower conspiracy beliefs: A meta-analysis. *Judgment and Decision Making*, 17(4), 720–744.
<https://doi.org/10.1017/S1930297500008913>
- Žeželj, I., & Lazarević, L. B. (2019). Irrational beliefs. *Europe's Journal of Psychology*, 15(1), 1–7.
<https://doi.org/10.5964/ejop.v15i1.1903>
- Žeželj, I., Pavlović, M., Vladislavljević, M., & Radivojević, B. (2009). Construction and behavioral validation of superstition scale. *Psihologija*, 42(2), 141–158.
<https://doi.org/10.2298/PSI0902141Z>
- Žeželj, I., Petrović, M., Ivanović, A., & Kurčubić, P. (2023). I trust my immunity more than your vaccines: “Appeal to nature” bias strongly predicts questionable health behaviors in the COVID-19 pandemic. *PLOS ONE*, 18(2), e0279122.
<https://doi.org/10.1371/journal.pone.0279122>

Chapter 2 - Supplementary information

Supplement S1

Additional analyses

Table S1.1

Means, standard deviations, reliability, and correlations corrected for attenuation of doublethink, irrational beliefs, and information processing style (Study 1)

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
1. Doublethink (0-11)	4.28	2.37	<i>0.73</i>									
2. Conspiracy mentality (1-5)	3.95	0.75	.43	<i>0.77</i>								
3. Magical health beliefs (1-5)	2.86	0.88	.45	.71	<i>.89</i>							
4. New age philosophy paranormal beliefs (1-7)	2.96	1.39	.17	.50	.69	<i>.91</i>						
5. Traditional paranormal beliefs (1-7)	2.99	1.51	.25	.51	.63	.87	<i>.82</i>					

Table S1.1 continued

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10
6. Superstition (1-5)	2.08	0.72	.31	.35	.45	.62	.65	.87				
7. Actively open-minded thinking (1-6)	4.78	0.87	-.45	-.27	-.31	-.31	-.34	-.46	.79			
8. Need for cognitive closure (1-6)	4.11	0.78	.40	.21	.12	.03	.11	.32	-.37	.84		
9. Rational thinking style (1-5)	4.05	0.82	-.09	-.08	-.07	-.11	-.23	-.27	.20	-.22	.75	
10. Experiential thinking style (1-5)	3.39	0.97	.11	.33	.37	.40	.35	.27	-.12	-.24	-.02	0.77

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. The main diagonal shows reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2022) and Cronbach's alpha for all other measures)

Table S1.2

Means, standard deviations, and correlations corrected for attenuation of doublethink and different health behaviors - Study 1

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. Doublethink (0-11)	4.28	2.37	.73		
2. Intentional non-adherence to medical recommendations (0-1)	0.55	0.34	.19	.57	
3. Use of TCAM (0-1)	0.29	0.16	-.02	.32	.39

Note. For 4., higher scores indicate more preference for simultaneous use of conventional and alternative medicine. *M* and *SD* are used to represent mean and standard deviation, respectively. The main diagonal shows the reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2022) and Cronbach's alpha for all other measures)

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

Table S1.3*Regression results using intentional non-adherence as the criterion - Study 1*

Predictor	<i>b</i>	<i>beta</i>	<i>Beta</i> 95% CI [LL, UL]	Fit	Difference
Actively open-minded thinking	-0.04	-0.09	[-0.21, 0.03]	$R^2 = .004$	
Need for cognitive closure	0.02	0.05	[-0.07, 0.17]		
Rational thinking style	0.01	0.02	[-0.09, 0.14]		
Experiential thinking style	0.02	0.07	[-0.05, 0.18]		
Actively open-minded thinking	-0.01	-0.04	[-0.17, 0.09]	$R^2 = .014$ $\Delta R^2 = .010$	
Need for cognitive closure	0.01	0.02	[-0.11, 0.15]		
Rational thinking style	0.02	0.05	[-0.07, 0.16]		
Experiential thinking style	0.01	0.02	[-0.11, 0.14]		
Doublethink	0.01	0.07	[-0.06, 0.20]		
Conspiracy mentality	0.01	0.02	[-0.12, 0.17]		
Magical health beliefs	-0.02	-0.05	[-0.22, 0.11]		
New age philosophy beliefs	0.01	0.02	[-0.18, 0.21]		
Traditional paranormal beliefs	0.04	0.18	[0, 0.35]		
Superstition	-0.01	-0.01	[-0.16, 0.14]		

Note. A significant *b*-weight indicates the beta-weight is also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

** indicates $p < .01$.

Table S1.4*Regression results using TCAM use as the criterion - Study 1*

Predictor	<i>b</i>	<i>beta</i>	<i>Beta</i> 95% CI [LL, UL]	Fit	Difference
Actively open minded thinking	-0.00	-0.01	[-0.13, 0.11]		
Need for cognitive closure	0.02	0.12	[-0.00, 0.24]		
Rational thinking style	-0.01	-0.07	[-0.18, 0.05]		
Experiential thinking style	0.03**	0.16	[0.04, 0.27]		
				$R^2 = .028^*$	
Actively open minded thinking	0.01	0.08	[-0.04, 0.19]		
Need for cognitive closure	0.02*	0.12	[0.00, 0.23]		
Rational thinking style	-0.00	-0.03	[-0.13, 0.08]		
Experiential thinking style	0.00	0.02	[-0.10, 0.13]		
Doublethink	-0.01**	-0.16	[-0.28, -0.05]		
Conspiracy mentality	-0.02	-0.11	[-0.24, 0.01]		
Magical health beliefs	0.06***	0.35	[0.20, 0.50]		
New age philosophy beliefs	0.01	0.08	[-0.10, 0.25]		
Traditional paranormal beliefs	0.02*	0.17	[0.01, 0.33]		
Superstition	0.02	0.07	[-0.06, 0.21]		
				$R^2 = .215^{***}$	$\Delta R^2 = .187^{***}$

Note. A significant *b*-weight indicates the beta-weight is also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

Table S1.5*Means, standard deviations, and correlations corrected for attenuation - Study 2*

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. Doublethink (0-11)	4.10	2.25	.68		
2. iNAR (0-1)	0.36	0.21	.09	.68	
3. TCAM (0-1)	0.37	0.17	.02	.32	.79
4. Relationship between alternative and conventional medicine - attitudinal indicator (1-7)	4.65	1.79	.30	.12	.49

Note. For 4., higher scores indicate that conventional and alternative medicine are seen/used as more compatible. *M* and *SD* are used to represent mean and standard deviation, respectively. The main diagonal shows reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2022) and Cronbach's alpha for all other measures)

Supplement S2

Robustness analysis - Study 1

We aimed to exclude participants detected as univariate outliers whose mean score on doublethink was more than three times the median absolute deviation ($3 \times \text{MAD}$) away from the median score (Leys et al., 2013). However, we did not find any such outliers. Variables with skewness and kurtosis over 0.5 were normalized using the Rankit transformation (Solomon & Sawilovsky, 2009). Those were all but doublethink, need for cognitive closure and intuitive thinking style.

Table S2.1*Reliability and correlations of doublethink, irrational beliefs, and information processing style (Study 1)*

Variable	1	2	3	4	5	6	7	8	9	10
1. Doublethink	.73									
2. Conspiracy mentality	.31***	.77								
3. Magical health beliefs	.35***	.58***	.89							
4. New age philosophy paranormal beliefs	.12	.42***	.60***	.91						
5. Traditional paranormal beliefs	.18*	.41***	.52***	.74***	.82					
6. Superstition	.23**	.28***	.40***	.56***	.54***	.87				
7. Actively open-minded thinking	-.32***	-.20**	-.23***	-.26***	-.28***	-.36***	.79			
8. Need for cognitive closure	.30***	.18*	.10	.03	.11	.26***	-.30***	.84		
9. Rational thinking style	-.06	-.06	-.06	-.12	-.19*	-.23***	.16	-.16	.75	
10. Experiential thinking style	.08	.25***	.30***	.35***	.27***	.24***	-.09	-.19*	-.02	.77

Note. The main diagonal shows reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2022) and Cronbach's alpha for all other measures)

All *p* values were adjusted for multiple observations using Holm's method.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

Table S2.2

Means, standard deviations, and correlations of doublethink and different health behaviors - Study 1

Variable	1	2	3
1. Doublethink	.73		
2. Intentional non-adherence to medical recommendations	.11	.49	
3. Use of TCAM	-.01	.14	.39
4. Preference for simultaneous use of conventional and alternative medicine	.03	.18**	.36***

Note. For 4., higher scores indicate more preference for simultaneous use of conventional and alternative medicine. The main diagonal shows the reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2021) and Cronbach's alpha for all other measures)

All *p* values were adjusted for multiple observations using Holm's method. * indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

Path analysis

Table S2.3

Path analysis with TCAM and iNAR as outcomes - Study 1

Outcome	Predictor	Estimate	Standardized estimate	<i>p</i>
iNAR				
	Actively open minded thinking	-0.037	-.042	.518
	Need for cognitive closure	0.028	.026	.687
	Rational thinking style	0.045	.049	.406
	Experiential thinking style	0.023	.026	.673
	Doublethink	0.027	.075	.263
	Conspiracy mentality	0.018	.020	.779
	Magical health beliefs	-0.050	-.058	.473
	New age philosophy beliefs	0.022	.025	.795
	Traditional paranormal beliefs	0.156	.173	.046
	Superstition	0.000	.000	.899

Table S2.3 continued

Outcome	Predictor	Estimate	Standardized estimate	<i>p</i>
TCAM				
	Actively open minded thinking	0.054	.056	.320
	Need for cognitive closure	0.142	.118	.061
	Rational thinking style	-0.026	-.026	.600
	Experiential thinking style	0.015	.015	.781
	Doublethink	-0.066**	-.167**	.005
	Conspiracy mentality	-0.115*	-.119*	.043
	Magical health beliefs	0.338***	.358***	<.001
	New age philosophy beliefs	0.086	.090	.264
	Traditional paranormal beliefs	0.155*	.158*	.042
	Superstition	0.054	.057	.361

Note. Significant predictors are printed in bold.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$

Table S2.4*Regression results using intentional non-adherence as the criterion - Study 1*

Predictor	<i>b</i>	<i>beta</i>	<i>Beta</i> 95% CI [LL, UL]	Fit	Difference
Actively open-minded thinking	-0.08	-0.09	[-0.19, 0.02]		
Need for cognitive closure	0.06	0.06	[-0.07, 0.20]		
Rational thinking style	0.02	0.03	[-0.08, 0.13]		
Experiential thinking style	0.07	0.08	[-0.03, 0.17]		
				$R^2 = .007$	
Actively open-minded thinking	-0.04	-0.04	[-0.17, 0.09]		
Need for cognitive closure	0.03	0.03	[-0.10, 0.15]		
Rational thinking style	0.05	0.05	[-0.07, 0.17]		
Experiential thinking style	0.02	0.03	[-0.10, 0.15]		
Doublethink	0.03	0.07	[-0.05, 0.20]		
Conspiracy mentality	0.02	0.02	[-0.13, 0.16]		
Magical health beliefs	-0.05	-0.06	[-0.22, 0.11]		
New age philosophy beliefs	0.02	0.03	[-0.17, 0.22]		
Traditional paranormal beliefs	0.16	0.17	[0-0.35]		
Superstition	0.00	0.00	[-0.15, 0.15]		
				$R^2 = .019$	$\Delta R^2 = .012$

Note. A significant *b*-weight indicates the beta-weight is also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

Table S2.5*Regression results using TCAM use as the criterion - Study 2*

Predictor	<i>b</i>	<i>beta</i>	<i>Beta</i> 95% CI [LL, UL]	Fit	Difference
Actively open-minded thinking	-0.02	-0.02	[-0.14, 0.10]		
Need for cognitive closure	0.14	0.11	[-0.01, 0.23]		
Rational thinking style	-0.07	-0.07	[-0.18, 0.04]		
Experiential thinking style	0.15**	0.16	[0.05, 0.27]		
				$R^2 = .030^*$	
Actively open-minded thinking	0.05	0.06	[-0.06, 0.17]		
Need for cognitive closure	0.14*	0.12	[0.00, 0.23]		
Rational thinking style	-0.03	-0.03	[-0.13, 0.08]		
Experiential thinking style	0.01	0.02	[-0.10, 0.13]		
Doublethink	-0.07**	-0.17	[-0.28, -0.05]		
Conspiracy mentality	-0.12	-0.12	[-0.25, 0.01]		
Magical health beliefs	0.34***	0.36	[0.21, 0.50]		
New age philosophy beliefs	0.09	0.09	[-0.08, 0.26]		
Traditional paranormal beliefs	0.15*	0.16	[0, 0.31]		
Superstition	0.05	0.06	[-0.08, 0.19]		
				$R^2 = .217^{**}$	$\Delta R^2 = .187^{**}$

Note. A significant *b*-weight indicates the beta-weight is also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

Supplement S3

Robustness analysis - Study 2 (Table S3.1)

We aimed to exclude participants detected as univariate outliers whose mean score on doublethink was more than three times the median absolute deviation ($3 \times \text{MAD}$) away from the median score (Leys et al., 2013). We found 14 participants like that and removed them from all subsequent analyses. Variables with skewness and kurtosis over 0.5 were normalized using the Rankit transformation (Solomon & Sawilovsky, 2009). Those were all but trust in the wisdom of the common man.

Moderation analyses

As for the moderation of the relation between iNAR and TCAM, there was again a significant main effect found between iNAR and TCAM ($\beta = .220, p < .001$), however, there was no significant main effect of doublethink on TCAM use ($\beta = -0.011, p = .822$). There was also no moderating effect of doublethink ($\beta = -.049, p = .333$).

Similar to the original analysis, we found no moderating effect of doublethink on the relation between trust in science and the wisdom of the “common man” ($\beta = -.013, p = .830$). We did not find a main effect of trust in science ($b = -.070, p = .220$), but there was a significant main effect of doublethink ($\beta = .170, p = .002$).

Table S3.1*Correlations of all used variables - Study 2*

Variable	1	2	3	4	5	6
1. Doublethink	.72					
2. iNAR	.07	.68				
3. TCAM	.01	.22***	.79			
4. Trust in science	-.02	-.17*	-.21***	/		
5. Trust in the wisdom of the common man	.17*	.13	.34***	-.07	/	
6. Relationship between alternative and conventional medicine - attitudinal indicator	.20**	.10	.42***	-.17*	.37***	.94
7. Relationship between alternative and conventional medicine - behavioral indicator	.04	.13	.35***	-.25***	.24***	.50***

Note. For 6. and 7., higher scores indicate that conventional and alternative medicine are seen/used as more compatible. The main diagonal shows reliability of all measures (GLB for doublethink (Petrović & Žeželj, 2021) and Cronbach's alpha for all other measures)

All *p* values were adjusted for multiple observations using Holm's method.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$

Chapter 3

Paper 2 | Both a bioweapon and a hoax: the curious case of contradictory conspiracy theories about COVID-19

This is the accepted, peer-reviewed version of the paper. Please cite as:

Petrović, M., & Žeželj, I. (2023). Both a bioweapon and a hoax: The curious case of contradictory conspiracy theories about COVID-19. *Thinking & Reasoning*, 29(4), 456–487.

<https://doi.org/10.1080/13546783.2022.2088618> (Published online 2022)



Both a bioweapon and a hoax: the curious case of contradictory conspiracy theories about COVID-19

Marija Petrović*  and Iris Žeželj* 

Faculty of Philosophy, University of Belgrade, Belgrade, Serbia

ABSTRACT

Amidst the flow of conspiracy theories (CTs) about the COVID-19 pandemic, many were logically incompatible. We aimed to map the psychological profile of their endorsers. Upon pretesting for familiarity and logical incompatibility, we choose eight pairs of contradictory COVID-19 CTs. Across three studies, a substantial portion of respondents (40%–42%) endorsed at least one pair. In Study 1 ($N = 290$), conspiracy mentality and doublethink, but not preference for consistency, meaningfully related to endorsement of contradictory CTs; doublethink contributed over and above other predictors. In two following studies we introduced indicators of superficial (Study 2; $N = 281$) and analytical (Study 3; $N = 170$) information-processing as predictors. The endorsers of contradictory CTs were more intuitive, prone to ontological confusions and pseudo-profound bullshit, less rational and less actively open-minded; doublethink again added to the prediction. We end by suggesting how the interventions should be tailored to address people with such distinct information-processing style.

ARTICLE HISTORY Received 1 July 2021
Accepted 7 June 2022

KEYWORDS COVID-19 conspiracy theories; inconsistent beliefs; doublethink; superficial information processing; thinking style

[MAGA thought process: We must punish evil China for sending this horrible virus that is just the common cold and we don't need masks but Trump was a hero for wearing one that one time and God bless him for inventing the miraculous vaccine we're not going to take.]

(tweet by Patrick W. Watson,
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CONTACT Iris Žeželj  izezelj@f.bg.ac.rs  Faculty of Philosophy, University of Belgrade, Čika Ljubina 18-20, Belgrade 11000, Serbia.
#Shared first authorship.

 Supplemental data for this article is available online at <https://doi.org/10.1080/13546783.2022.2088618>.

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Acknowledgement

This work is a part of Marija Petrović's PhD thesis entitled "Consistently inconsistent: predictivity and validity of doublethink" at the University of Belgrade, supervised by Dr. Iris Žeželj.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was funded by Ministry of Education, Science and Technological Development of the Republic of Serbia.

ORCID

Marija Petrović  <http://orcid.org/0000-0001-6422-3957>

Iris Žeželj  <http://orcid.org/0000-0002-9527-1406>

References

- Alkali, Y. E., & Amichai-Hamburger, Y. (2004). Experiments in digital literacy. *Cyberpsychology & Behavior, 7*(4), 421–429. <https://doi.org/10.1089/cpb.2004.7.421>
- Allington, D., Duffy, B., Wessely, S., Dhavan, N., & Rubin, J. (2021). Health-protective behaviour, social media usage and conspiracy belief during the COVID-19 public health emergency. *Psychological Medicine, 51*(10), 1763–1769. <https://doi.org/10.1017/S003329172000224X>
- Alper, S., Bayrak, F., & Yilmaz, O. (2020). Psychological correlates of COVID-19 conspiracy beliefs and preventive measures: Evidence from Turkey. *Current Psychology, 40*, 5708–5717. <https://doi.org/10.1007/s12144-020-00903-0>
- Bertin, P., Nera, K., & Delouvée, S. (2020). Conspiracy beliefs, rejection of vaccination, and support for hydroxychloroquine: A conceptual replication-extension in the COVID-19 pandemic context. *Frontiers in Psychology, 11*, 565128. <https://doi.org/10.3389/fpsyg.2020.565128>
- Bierwaczzonek, K., Kunst, J. R., & Pich, O. (2020). Belief in COVID-19 conspiracy theories reduces social distancing over time. *Applied Psychology. Health and Well-Being, 12*(4), 1270–1285. <https://doi.org/10.1111/aphw.12223>
- Bruder, M., Haffke, P., Neave, N., Nouripanah, N., & Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: Conspiracy Mentality Questionnaire. *Frontiers in Psychology, 4*, 225. <https://doi.org/10.3389/fpsyg.2013.00225>
- Cialdini, R. B., Trost, M. R., & Newsom, J. T. (1995). Preference for consistency: The development of a valid measure and the discovery of surprising behavioural implications. *Journal of Personality and Social Psychology, 69*(2), 318–328. <https://doi.org/10.1037/0022-3514.69.2.318>

Both a bioweapon and a hoax: The curious case of contradictory conspiracy theories about COVID-19

Marija B. Petrović ^{a*}, & Iris Žeželj ^{a*}

^aFaculty of Philosophy, University of Belgrade, Belgrade, Serbia

*Shared first authorship

Author Note

Corresponding author: Iris Žeželj, Čika Ljubina 18-20, 11000 Belgrade, Serbia, e-mail: izezelj@f.bg.ac.rs, +381113206166

Acknowledgement

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Abstract

Amidst the flow of conspiracy theories (CTs) about the COVID-19 pandemic, many were logically incompatible. We aimed to map the psychological profile of their endorsers. Upon pretesting for familiarity and logical incompatibility, we choose eight pairs of contradictory COVID-19 CTs. Across three studies, a substantial portion of respondents (40%-42%) endorsed at least one pair. In Study 1 (N = 290), conspiracy mentality and doublethink, but not preference for consistency, meaningfully related to endorsement of contradictory CTs; doublethink contributed over and above other predictors. In two following studies we introduced indicators of superficial (Study 2; N = 281) and analytical (Study 3; N=170) information-processing as predictors. The endorsers of contradictory CTs were more intuitive, prone to ontological confusions and pseudo-profound bullshit, less rational and less actively open-minded; doublethink again added to the prediction. We end by suggesting how the interventions should be tailored to address people with such distinct information-processing style.

Word count: 150

Keywords: COVID-19 conspiracy theories, inconsistent beliefs, doublethink, superficial information processing, thinking style

Both a bioweapon and a hoax: The curious case of contradictory conspiracy theories about COVID-19

[MAGA thought process: We must punish evil China for sending this horrible virus that is just the common cold and we don't need masks but Trump was a hero for wearing one that one time and God bless him for inventing the miraculous vaccine we're not going to take.]

(tweet by Patrick W. Watson, <https://twitter.com/patrickw/status/1334954936879214596?lang=en>
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Amidst the so-called COVID-19 infodemic (World Health Organization, n. d.), online comment threads showcased a particular tendency in conspiracy theorizing – for example, people seem to have simultaneously believed that the coronavirus originated in 2019 in a lab in China, but also that it has been around for years. In Serbia, as in other parts of the world, conspiracy theories dominated online discourse surrounding the pandemic, and much of it was overflowing with inconsistencies. For example, there were claims that doctors were taking money to treat the supposed virus while the hospitals they worked in were actually empty, but that, at the same time, all of the hospitals were so overcrowded that people were sleeping in the corridors and toilets. We propose that individual differences in endorsing contradictory conspiratorial arguments can be traced back to two more basic tendencies: first, to a propensity towards conspiratorial interpretation of information, but also to a tendency to overlook inconsistencies, irrespective of their content. In this research, we first set out to explore to what extent people endorse mutually incompatible conspiracy theories (CTs) about the pandemic and if so, which ones. Next, we tested whether individual differences in this proneness can be predicted by the two basic tendencies. Finally, we analyzed whether this specific type of conspiratorial thinking is driven by a particular approach to information processing: more superficial, less analytical.

Tolerance for contradictions and belief in contradictory COVID-19 CTs

Until recently, individual differences in consistency have predominantly been explored within the cognitive consistency framework (Festinger, 1957) as a disposition labeled preference for consistency (Cialdini et al., 1995), which encompasses the desire to be internally consistent, as well as the need to appear consistent to others, while expecting the same from them. Preference for consistency moderates a range of different consistency phenomena, such as the cognitive dissonance in the counterattitudinal advocacy effect - those high on preference for consistency were more likely to alter their beliefs to make them consistent with their previous actions. Preference for consistency can only be measured through self-report measures that assess one's perception of personal consistency (Cialdini et al., 1995). However, if we move away from the prevalent notion that consistency is always a desired state in belief organization and instead suppose that people can easily be inconsistent in their beliefs, it allows us to define a different construct – a disposition towards concurrent acceptance of two incompatible beliefs or doublethink. Thus, when we set out to measure to doublethink, we need not rely on self-report measures, but can instead generate pairs of contradictory beliefs and directly test how many pairs people accept at the same time, as in the Proneness to doublethink scale (Petrović & Žeželj, 2021). We have previously demonstrated that it would be false to treat these constructs as the poles of a continuum, but that they are instead conceptually different, empirically weakly related and differentially predictive of other constructs. This is why we aimed to test which one of the two measures of (in)consistency is more predictive of

holding inconsistent beliefs in a specific domain – endorsement of contradictory COVID19-related CTs.

Conspiratorial worldview and belief in contradictory COVID-19 CTs

There are reasons to expect certain worldviews to be riddled with contradictions. For example, more than 70 years ago, Levinson and Sanford (1944) devised an antisemitism scale, in which they strategically incorporated pairs of contradictory items (e.g. "Jews are over-assimilative", but they are also "Strategically refusing to assimilate" or "Jews are proud people", but they also "Lack self respect"). The procedure “derived from the hypothesis that anti-Semites would agree with both items in each pair, “for such an inconsistency is an intrinsic aspect of anti-Semitism and helps to characterize it as irrational and destructive” (p. 367). This inconsistency in opinions, they argued, allows Jews no alternative, i.e. makes it impossible for them to act in a manner that would be acceptable for the majority group. Similarly, the internal inconsistency has often been mentioned as a core feature of the conspiratorial worldview (Lewandowsky & Cook, 2020). This is partially due to its so-called monological structure, in which one belief supports the other (Goertzl 1994; Swami et al., 2011) and makes them notoriously hard to confront (Lazić & Žeželj, 2021). This structure allows contradictory beliefs about the same event to simultaneously exist, if they are supported by a higher order narrative (often as vague as “the official version of events is not true”) (Lukić et al., 2019; Wood et al., 2012). If contradictory beliefs arise purely from higher order conspiratorial narratives, they should then encompass all of the lower order beliefs, even contradictory ones, and hence should be sufficient to explain the unexpected positive correlation between contradictory conspiratorial beliefs (Wood et al., 2012; Wood, 2017).

There is a substantial number of people who endorse conspiratorial beliefs about the virus across different countries (Douglas & Sutton, 2020; van Mulukom et al., 2022). The studies suggest CTs may be detrimental to public acceptance of different preventive measures against the disease, such as non-adherence to recommended COVID-19 safety measures (Allington et al., 2020; Bierwiazzonek et al., 2020; Imhoff & Lamberty, 2020; Romer & Jamieson, 2020; Teovanović et al., 2020) and vaccine hesitancy (Bertin et al., 2020; Romer & Jamieson, 2020; Teovanović et al., 2020). There is already scattered evidence for endorsements of some COVID-19 related contradictory CTs. For example, people who believe that the virus was intentionally released by China are also more likely to believe that it was accidentally released by China (Miller, 2020).

The first step in this research was thus to systematize higher order COVID-19 related CTs and their contradictory offsprings in order to develop a reliable instrument to assess individual differences in their endorsement.

Development of Belief in contradictory COVID-19 CTs scale

Deriving contradictory COVID CTs

To derive most relevant contradictory conspiratorial arguments about the pandemic, we started with a content analysis of social media comments on pandemic-related news in the most read Serbian digital outlets. We identified the most common themes challenging the official narratives of public and health officials regarding the pandemic, and then generated pairs of contradictory narratives in their support (Table 1). Apart from the fact that it had to be prevalent in the public discourse, we labeled a narrative as conspiratorial if it *a.* went against the official version of events, and *b.* contained claims of malevolent intents that weren't corroborated at the moment.

While most of the chosen claims were clear-cut, the two criteria suggested we included a claim that officials were intentionally reporting lower numbers of infected. We decided to leave it

in, even though there were indications that the reported numbers were lower than they should have been, because it remains to be seen whether it was due to intent to deceive the public, a consequence of a lack of resources to accurately track them, or of sheer incompetence. More importantly, we decided to keep this particular claim despite its contested conspiratorial nature, because we were not concerned primarily with responses to individual CTs, but rather the conjoint responding to the pair. As such, a person believing that the officials are intentionally reporting lower numbers would not be characterized as prone to contradictory CTs, unless they also believed that the tests are rigged to show positive results at the same time.

Assessing compatibility and familiarity of CTs

To make sure that the included theories were (a) familiar and (b) truly logically incompatible with each other (contradictory), we then recruited 44 independent expert raters. Post-graduate students at the Faculty of philosophy, University of Belgrade, served as experts. First, they assessed the familiarity of each CT individually on a scale from 1 (*not at all familiar*) to 7 (*completely familiar*). We proceeded to show them the pairs of contradictory items, and asked them to rate the pair on a 7-point Likert-type scale from 1 (*not at all contradictory*) to 7 (*fully contradictory*), such that both items in the pair cannot be true at the same time. Item selection was based on two criteria: items in a pair had to be more familiar than not (average familiarity > 4) and also rated as highly contradictory (average contradictory score > 5). We additionally included three pairs that were extremely contradictory (6 or above), but whose familiarity was somewhat below the set criteria. All of the pretested items that we excluded during this process are available in Supplement A of the Supplementary material.

The final scale of contradictory COVID-19 related CTs included eight pairs (16 items) of contradictory CTs; participants indicated their agreement on a 4-point Likert scale. We opted for a 4-point response scale and transformed it into a binary one for two main reasons. First, even though endorsement of conspiracy theories is typically a continuum with a relatively small number of respondents on the extreme, the very notion of contradiction encompasses a binary approach: it can only exist if we assume that one endorses two incompatible beliefs. Second, as inconsistency has been highlighted as central to an individual’s conspiratorial worldview, we wanted to avoid a variable-centered approach, i.e. reporting on correlations between the contradictory CTs (as in Wood et al., 2012) and instead develop a measure of individual differences in this tendency. Admittedly, to push the respondents into weighing their endorsement and decide whether it is predominantly on the Yes or No side, we left out the midpoint of the scale, but we still left them two points on each side to express their level of endorsement.

Table 1
Higher order narratives with corresponding contradictory CT item pairs and their average familiarity and incompatibility, as rated by 44 post-graduate psychology students

Higher order narratives	Item pairs	Familiarity	Incompatibility
The origin of the virus is not what is officially claimed	1. America planted the coronavirus in China to weaken their economic growth, but that backfired on them.	4.8	6.6

2. China clearly made the virus in order to establish world domination.

1. The coronavirus was produced to ensure the tracking of the world population through vaccination.

2. The coronavirus was produced to finally solve the overpopulation issue.

5.7

3.2

1. If you've heard Bill Gates' speech from a few years back about the threat of a pandemic and the significance of vaccines, you know that he is behind the coronavirus pandemic.

2. It's no wonder there's a coronavirus pandemic when it is well known that Chinese authorities have been opening dangerous biochemical labs for years.

4.9

4.6

1. It's no wonder that after decades of dangerous experiments the virus finally escaped from the lab in 2019 – no one believes that it was accidentally transferred from animals.

2. This coronavirus has been circling in the human population for years, but was just now conveniently revealed.

4.6

5.2

There are powerful conspirators behind the virus spread

1. The pandemic was orchestrated by the pharmaceutical industry.

2. The pharmaceutical industry has overstated the pandemic only to shamelessly profit off of it.

5.5

2

1. Refugees are paid to spread the coronavirus.

2. The pandemic was orchestrated as a smokescreen for large-scale settlement of refugees.

2.7

4.8

1. It will become clear that the pandemic was only a smokescreen for the final reckoning with the agents of the deep state.

2. If you know anything about the deep state it is clear that that's who decided to cause this pandemic.

3

5.8

True seriousness of the health threat the virus poses is not what is officially claimed

1. There's now plenty of evidence that the coronavirus tests are rigged to show positive results.

2. The officials are intentionally hiding the fact that the numbers of infected are much higher than those reported.

5.3

5.6

1. Doctors are paid to supposedly treat the infected, and yet all the hospitals are empty.

2. The fact that the hospitals are so overcrowded that patients sleep in toilets is being hidden from the public.

3.1

6.8

1. The coronavirus is a powerful bioweapon made for the mass depopulation of the planet.

2. COVID-19 is nothing more than a common cold whose consequences are intentionally exaggerated.

6

6.6

1. This whole coronavirus thing is a mere media spin and a fabrication.

2. The disease attributed to the coronavirus is actually a consequence of radiation spread by the 5G network.

5.9

4.4

Actual protectiveness of advised measures is not what is officially claimed

1. It is clear that masks have no effect on health whatsoever, but are still imposed on us for profit.

2. Wearing a mask leads to carbon dioxide intake, which damages the lungs – more work for the pharmaceutical industry!

4.9

5

Vaccines aren't safe/ effective as officials claim	1. The globalists intentionally halted the vaccine approval process to ensure the pandemic does not end. 2. Mass vaccinations are a key step in the globalists' plan for world domination.	3.3	6.1
	1. COVID-19 vaccines contain only saline solution.		
	2. The pharmaceutical industry is well aware of the dangers of COVID-19 vaccines and yet insists on distributing them.	3.9	6.1
	1. The people in the media who are claiming they are getting COVID-19 jabs are actually all paid actors – no one was even vaccinated against the virus.		
	<i>2. The members of the elite are all getting vaccinated far from the public's eye.</i>	3.1	6.5

Note. The item pairs included in the final scale are in bold.

Study 1

Aims and hypotheses

The main goal of the first study was to determine if and to what extent people are prone to endorsing contradictory CTs about the pandemic. Furthermore, we wanted to contrast the contribution of higher order conspiratorial beliefs against the contribution of the metastructural tendency to tolerate inconsistencies regardless of the content, alongside the tendency to prefer consistency in general. If the tendency to endorse contradictory COVID-19 stems solely from an individual's proclivity towards conspiratorial thinking, then the role of doublethink in this tendency would be trivial after general conspiratorial beliefs are taken into account.

We expected that the endorsement of contradictory CTs would be positively related to conspiracy mentality (H1a), and doublethink (H1b) and negatively to preference for consistency (H1c). Additionally, we wanted to explore specifically how doublethink related to other constructs in the design, so we expected it to be positively related to conspiracy mentality (H2a) but negatively to preference for consistency (H2b). Finally, we hypothesized doublethink would contribute to prediction of belief in contradictory COVID-19 CTs over and above conspiracy mentality and preference for consistency (H3). All of the hypotheses, as well as the analyses and sampling plan were preregistered: <https://aspredicted.org/sp2pi.pdf>

Method

Measures

COVID-19 contradictory conspiracy theories. The scale consists of eight pairs (16 items in total) of contradictory COVID-19-related conspiratorial claims along with six buffer non-conspiratorial items related to the pandemic which were not scored; all items were presented individually. Participants rated how likely a statement is to be true on a scale from 1 (*definitely not true*) to 4 (*definitely true*), to avoid neutral answers. Participants' answers were then recoded to either a 0 (answers 1-2; not true) or 1 (answers 3-4; true). The final score was counted as the number of pairs where participants thought both statements in a pair were true and ranged from 0 to 8 ($\alpha = .77$). Since all item distributions were asymmetrical, we also report the Greatest Lower Bound ($GLB = .83$) that could be more representative of internal consistency in such cases (Trizano-Hermosilla & Alvarado, 2016). To ensure that individual differences on the scale were not due to careless responding, we added three attention checks and set a rigorous criterion for exclusion (we did not allow for wrong responses). Additionally, we examined whether those more prone to contradictory COVID-19 CTs had shorter response times, which could also indicate less effort in responding. We did not observe a correlation between contradictory CTs proneness and overall time spent on the questionnaire ($r = .03, p = .569$), whilst the correlation with time spent on the scale itself was even positive ($r = .13, p = .026$).

Conspiracy mentality was assessed using the 5-item version of the questionnaire (CMQ; Bruder et al., 2013; Serbian adaptation in Đorđević et al., 2021), which measures general susceptibility to conspiracist ideation (e.g. *I think that government agencies closely monitor all citizens*). Participants rated the truthfulness of the items on a 1 (*completely incorrect*) to 100 (*completely correct*) slider ($\alpha = .78$).

Doublethink was assessed using the Proneness to doublethink scale (Petrović & Žeželj, 2021). The scale measures a person's tendency to concurrently accept mutually incompatible beliefs and consists of 11 pairs of contradictory items (e.g. *Some people are essentially irreparable* and its contradictory pair *Every single person is capable of growth and change*), with 5 pairs of non-contradictory items as buffers; all items are presented in two separate blocks. The scale covers a wide range of beliefs, from health to beliefs about human nature, worded as truisms to encourage their acceptance. Participants rate their agreement with the items on a Likert-type scale ranging from 1 (*completely disagree*) to 4 (*completely agree*), further recoded into either a 0 (1 and 2; disagree) or a 1 (3 and 4; agree). The final score is calculated by counting the number of pairs where a person agreed with both statements and ranges from 0 to 11 ($\alpha = .73$, GLB = .79). As with the belief in COVID-19 conspiracy theories, we found no evidence of people being more careless while responding to these items – no significant correlation was found with either the overall time spent on the questionnaire ($r = .01$, $p = .841$), or the two pages with doublethink items ($r = .02$, $p = .736$; $r = .03$, $p = .662$). The full scale is available at: <https://osf.io/ns4c9/>.

Preference for consistency was measured using the brief, 9-item version of the scale (Cialdini et al., 1995), measuring a person's preference for consistency in their own beliefs and behaviors, as well as those of others (e.g. *I want to be described by others as a stable, predictable person*). Participants indicate their agreement with the items on a 9-point Likert type scale ($\alpha = .84$).

Sampling

A total of 302 participants recruited via snowballing and posts on social media completed the questionnaires in full. We based the minimum sample size needed ($N = 190$) to be able to detect a local effect of doublethink $f^2 = 0.08$ in the hierarchical forced entry regression with 90% power at $\alpha = .01$ (see preregistration for details). As per the preregistration plan, we filtered out the ones who failed at least one of the three attention checks which left us with the final sample size of $N = 290$ (44% female, 53% male, 3% did not state their gender; average age 34.4 years ($SD = 12.71$)). Participants were not offered any incentives, and they completed the questionnaires in 14 minutes on average.

Results

Data was analyzed using R version 4.0.0 (R Core Team, 2020). All data and code are available at <https://osf.io/rbmkd/>

Measurement model

First, we conducted an exploratory factor analysis on tetrachoric correlations of the items of COVID-19 related CTs scale and used the unweighted least squares method (Li, 2016), given the binary nature of the scale. The scree criterion indicated that one factor was optimal, explaining 56% of variance. Both local and global CTs loaded on the same factor (all loadings $\geq .60$).

Endorsement of COVID-19 conspiracy theories

Table 2 shows the percentage of the sample that found the conspiracy items to be more likely than not (3-4 on a 1 to 4 scale). When interpreting these percentages, one can have two thresholds in mind. The first, stricter one, implies that the respondents perceive the items as mutually exclusive: in

that case, their co-occurrence should be zero. The second implies that the respondents perceive them as independent: we calculated this threshold as a product of proportions of endorsement on both of the items (we report this in the Table 2 underneath the endorsement of each pair). The most popular CTs were at the same time the most plausible ones: the claim that the local officials intentionally downplayed the reported numbers of infected, which as we discussed previously, has been a topic of contention in the Serbian media. While the endorsement of that particular CT was high, the simultaneous endorsement of its contradictory pair was relatively low, and is one of the few pairs where it was lower than the expected threshold for independent beliefs. The second most endorsed CT was about the so-called “[lab leak”, which was at the time also brought back in global scientific discourse as a very unlikely, although not fully dismissed option (Zimmer et al., 2021).

Table

2

Percent of the sample (Study 1) that accepts individual conspiratorial items (the percent of the sample that finds both of the items in the pair true)

Items	% that thinks is true (answers 3-4)	% that thinks both are true at the same time (% that thinks both are fully true at the same time)
a. Coronavirus tests are rigged to show positive results	26.6	
b. Officials intentionally report lower numbers of infected	59.3	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	15.8	10 (2.8)
a. Doctors are paid to supposedly treat COVID-19, while hospitals are actually empty	16.6	
b. Hospitals are so overcrowded that patients sleep in toilets	38.6	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	6.4	5.5 (2.1)
a. COVID-19 vaccines contain only saline solution	13.1	
b. Pharmaceutical companies knowingly distribute harmful COVID-19 vaccines	32.1	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	4.2	9.3 (3.8)

a. People claiming in the media that they got vaccinated are all paid actors	16.2	
b. Members of the world's elite are getting vaccinated far from the public's eye	44.5	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	7.2	4.5 (1.7)
<hr/>		
a. Masks have no effect on health whatsoever but are still imposed on us for profit.	27.9	
b. Wearing a mask leads to carbon dioxide intake which damages the lungs	29.3	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	8.2	22.1 (14.8)
a. Coronavirus is a bioweapon manufactured for the mass depopulation of the planet	35.5	
b. COVID-19 is nothing but a common cold whose consequences are intentionally exaggerated.	24.8	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	8.8	17.2 (9.3)
a. Coronavirus was planted into China by the Americans to damage the Chinese economy	22.1	
b. China has manufactured this virus to conquer the world	20.3	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	4.5	11 (4.5)
a. Virus has escaped in 2019 from the laboratory after decades of dangerous experiments; it is naive to believe it was accidentally transferred from animals	44.8	

b. This coronavirus has been circling in the human population for years, the opportunity presented itself for that to finally be revealed 31.7

Co-occurrence threshold for independent beliefs (a x b) 14.2

21.7 (10.7)

**Note.* The percentages reflect the percent of the sample that answered 3 or 4 on a 1 (definitely not true) to 4 (definitely true) scale. The percent of the sample that answered 4 on both items depicted in brackets. Co-occurrence calculated as a product of proportion for each belief.

A total of 40% of the participants endorsed at least one contradictory conspiracy pair. The most popular contradictory pair refers to masks with almost a quarter of the sample endorsing this contradictory pair. In total, the simultaneous endorsement of all pairs was above the threshold of mutual exclusivity (i.e. different from zero), and above the threshold of independent co-occurrence for all but three pairs. This illustrates that, for a non-trivial number of respondents, endorsement of one theory does not cancel out endorsement of its contradictory pair. Not only that, but they are not even independent, but instead support one another, building a larger conspiratorial worldview.

Relations between belief in contradictory CTs, cognitive (in)consistency and conspiratorial ideation

Table 3 details means, standard deviations and correlations for belief in contradictory CTs, doublethink, conspiracy mentality and preference for consistency. We normalized all skewed variables using the Rankit transformation (Solomon & Sawilovsky, 2009), but continue to report non-transformed descriptives for ease of interpretation. We opted for non-parametric correlations due to the skew of the belief in contradictory CTs distribution even after transformation, as per preregistration. On average, participants endorsed one pair of contradictory COVID-19 related CTs, and five out of eleven pairs of contradictory beliefs in the doublethink scale, with practically all participants (99% of the sample) endorsing at least one contradictory pair.

Table 3
Means, standard deviations, and Spearman correlations (Study 1)

	<i>M</i>	<i>SD</i>	1	2	3
1. Belief in contradictory conspiracy theories	1.01	1.62			
2. Doublethink	5.21	2.65	.44***		
3. Conspiracy mentality	71.32	21.75	.59***	.39***	
4. Preference for consistency	6.19	1.43	.06	.23***	.14*

Note. Correlations significant after Bonferroni-adjusting for all 6 correlations are printed in bold. * indicates $p < .05$. *** indicates $p < .001$.

As expected, belief in contradictory CTs was positively related to conspiracy mentality (H1a) and doublethink (H1b), but contrary to H1c, not related to preference for consistency. Similarly, doublethink was positively related to conspiracy mentality (H2a), yet it was positively instead of negatively (H2b) related to preference for consistency. The latter finding, alongside the positive

relation of preference for consistency to conspiracy mentality, suggest that its nature might be different from what the theory proposes.

To test our final hypothesis (H3), we ran a hierarchical forced entry regression, entering preference for consistency and conspiracy mentality as predictors in the first step, and doublethink in the second step, while predicting belief in contradictory CTs (Table 4).

Table 4
Hierarchical forced entry regression with belief in COVID-19 contradictory CTs as the outcome (Study 1)

	<i>B [95% CI]</i>	<i>S.E.</i>	β	<i>t</i>
Step 1				
Conspiracy mentality	0.460 [0.380,0.541]	0.041	0.558	11.313***
Preference for consistency	0.009 [-0.069,0.088]	0.04	0.012	0.236
Step 2				
Doublethink	0.225 [0.140,0.310]	0.043	0.272	5.213***
Conspiracy mentality	0.378 [0.295,0.460]	0.042	0.457	8.971***
Preference for consistency	-0.034 [-0.111,0.043]	0.039	-0.042	-0.869

Note. B - unstandardized regression coefficient. S.E. - standard error for B. β - standardized regression coefficient
*** $p < .001$

In the first step the model was significant ($F(2, 287) = 65.39, p < .001; R^2_{adj} = .308$), however, only conspiracy mentality significantly contributed to the prediction. Once doublethink is included in the model, it remains significant ($F(3, 286) = 56.63, p < .001; R^2_{adj} = .366, \Delta R^2 = .058, p < .001$) and both conspiracy mentality and doublethink contribute to prediction. Doublethink explained an additional 6% of variance over and above the contribution of conspiracy mentality and preference for consistency (local effect size of $f^2 = 0.10$; H3).

To further disentangle the unique contributions of general tendency for consistency and doublethink to the prediction of belief in contradictory COVID-19 CTs, and to more accurately model it as a latent variable, we additionally fitted a SEM model, which was fully in line with the above results. The SEM analysis can be found in Supplement B of the Supplementary material.

Superficial information processing and endorsement of contradictory COVID-19 CTs

Once we demonstrated that people are prone to believing in contradictory CTs, we assumed that, given the proliferation of contradictory information during the pandemic, a particular style of information processing might make people particularly vulnerable to their endorsement. Borrowing from the dual process theory, we use the umbrella term superficial information processing (e.g. Fonseca et al., 2014); similar tendencies have also been referred to as miserly information processing (Toplak et al., 2013).

Cognitive-experiential theory (Epstein, 2014) proposes two modes of information processing – analytical, which is more deliberate and evidence-based, and experiential, which is intuitive and relies on implicit beliefs. There is evidence that preference for analytical thinking (Alper et al., 2020; Erceg et al., 2020; Stanley et al., 2020; Stoica & Umbreş, 2021, Swami & Barron, 2020, Teovanović et al., 2020) is related to lesser endorsement of COVID-19 CTs. Conversely, intuitive thinking relates to more endorsement of COVID-19 related CTs (Alper et al., 2020; Erceg et al., 2020). We thus wanted to test whether proneness to contradictory COVID-19 CTs would follow the same pattern.

Apart from preferences for global thinking styles, the syndrome of superficial information processing also includes more specific ways to assess information. Pseudo-profound bullshit receptivity is a person's ability to discern meaningful statements from meaningless, buzzword-filled ones (Pennycook et al., 2015). It was previously related to belief in CTs (Hart & Graether, 2018; Pennycook et al., 2015) and more recently to COVID-19 conspiratorial beliefs (Pennycook et al., 2021). While bullshit receptivity refers to an inability to discern between meaningful and vacuous statements, ontological confusions (Lindeman & Aarnio, 2007) refer to an inability to discern between ontological categories and the processes related to them. This means that a person tends to, for example, erroneously attribute mental processes to physical objects. Ontological confusions are predictive of a range of epistemically unwarranted beliefs (Lobato et al., 2014), including CTs (Rizeq et al., 2020). This is why we expected that those who are unable to detect bullshit and those prone to ontological confusions will also be less likely to detect inconsistencies in CTs, leading to more endorsement of contradictory conspiracy beliefs.

Finally, we also wanted to explore whether people prone to contradictory conspiracies lack in digital literacy - a set of cognitive skills, one of which is the skill to evaluate information (Alkali & Amichai-Hamburger, 2004). Since conspiracies are disseminated online, a superficial search for information (e.g. not paying attention to the sources, date of publishing, triangulating the information, etc) might lead to more exposure to, and thus more endorsement of contradictory conspiracies about the virus.

Study 2

Aims and hypotheses

Building on the findings of Study 1, this study aimed to explore how different types of superficial information processing are related to belief in contradictory COVID-19 CTs. Additionally, we wanted to test whether doublethink can contribute to the prediction on top of the other predictors, given that it can also be subsumed under the umbrella term of superficial information processing style.

We expected that intuitive thinking style (H1a), pseudo-profound bullshit receptivity (H1b), ontological confusions (H1c) and doublethink (H1d) would contribute positively, while rational thinking style (H1e) and digital literacy (H1f) would contribute negatively to the prediction of belief in contradictory COVID-19 conspiracies. We also expected that (H2) doublethink would contribute to the prediction of belief in contradictory CTs over and above all other predictors. Finally, we expected doublethink to be positively related to ontological confusions (H3a), intuitive thinking style (H3b), and pseudo-profound bullshit receptivity (H3c), but negatively to rational thinking style (H3d) and digital literacy (H3e). All hypotheses and analyses were preregistered: <https://aspredicted.org/ic5m6.pdf>.

Method

Measures

Thinking styles. The short form of the Rational-Experiential Inventory was used to measure preference for the experiential and rational thinking styles (Epstein et al., 1996). The scale consists of two subscales (5 items each, example items: *I prefer complex problems to simple ones*; *I believe in trusting my hunches.*). Participants indicate their agreement on a 5-point Likert-type scale, anchored with 1 (*very atypical of me*) to 5 (*very typical of me*). The internal consistency was $\alpha = .84$ for the intuitive and $\alpha = .70$ for the rational subscale.

Pseudo-profound bullshit receptivity was measured with the 10-item version of the scale (Pennycook et al., 2015a). Participants rated how profound they found the items (e.g. *Wholeness quiets infinite phenomena.*) to be on a scale from 1 (*not at all profound*) to 5 (*very profound*); $\alpha = .82$.

Ontological confusions were assessed by the 14-item version of the Core Knowledge Confusions scale (Lindeman & Aarnio, 2007; Lindeman et al., 2015) consisting of statements representing different ontological categories and processes (e.g. *Plants know the seasons*) which respondents rate on a scale anchored with 1 (*completely metaphorical*) to 5 (*completely literal*); $\alpha = .83$.

Digital literacy. We used the Digital Literacy Scale (UNICEF, 2017) which consists of 7 items measuring how people search for and evaluate information online (e.g. *I check the date of publication of texts online.*). Participants answer using a 7-point scale from 1 (*never*) to 7 (*always*); $\alpha = .68$.

Doublethink ($\alpha = .71$, $GLB = .76$) and belief in contradictory CTs ($\alpha = .59$, $GLB = .71$) were measured using the same scales as in Study 1, with one exception - we omitted the pair “*Masks have no effect on health whatsoever but are still imposed on us for profit.*” and “*Wearing a mask leads to carbon dioxide intake which damages the lungs.*” from the total contradictory CTs score calculation. Although it was worded to imply contradiction (“no effect on health whatsoever”), and assessed by experts as highly contradictory, we reasoned it might still be the case that certain respondents interpreted it in a non-contradictory manner (“no effect against the virus”), so we wanted to make sure to include only those items that do not allow for this.

Similar to Study 1, there were no significant relations between the time spent on the questionnaire and the scores on either doublethink ($r = -.07$, $p = .267$) or belief in contradictory COVID-19 CTs ($r = .07$, $p = .266$); the correlations with time spent on individual scales were non-significant as well: both with doublethink ($r = -.03$, $p = .640$; $r = .07$, $p = .256$) and with belief in contradictory CTs ($r = -.11$, $p = .068$).

Sampling

We recruited a total of 303 participants via social media posts and from the University of Belgrade participant pool (one third of the sample were first year sociology students who took part in exchange for course credits). The average completion time was 16 minutes. As in Study 1, we based the minimum sample size needed ($N = 188$) to be able to detect a local effect of doublethink of $f^2 = 0.07$, with power 95% at $\alpha = .05$ (see preregistration). We set an even higher criteria for careless responding and incorporated five instead of three attention checks in the questionnaire. Upon excluding those who failed one or more out of five attention checks, as per preregistration, the final

sample consisted of a total of N = 281 participants (71% female; 27% male and 2% other/rather not say; average age was 33.1 (SD = 14.14)).

Results

Measurement model

To confirm the underlying latent structure of the scale, we ran a confirmatory factor analysis on eight pairs of contradictory CTs. We fitted a one-factor model, using the three-stage robust diagonally weighted least squares estimator (DiStefano & Morgan, 2014). The model fitted the data well ($\chi^2(14, N=281) = 25.133, p = .033; \chi^2/df = 1.80; CFI = 0.95, TLI = 0.93; RMSEA = 0.05$ (90% CI 0.02-0.09), close fit test non-significant ($p = .396$)).

Endorsement of COVID-19 conspiracy theories

Both the endorsement of individual COVID-19 CTs, as well as contradictory pairs, was similar to Study 1 (Table 5).

Table 5

Percent of the sample (Study 2) that accepts individual conspiratorial items (the percent of the sample that finds both of the items in the pair true)

Items	% of the sample that thinks is true (answers 3-4)	% of the sample that thinks both are true at the same time (% that thinks both are fully true at the same time)
a. Coronavirus tests are rigged to show positive results	33.1	
b. Officials intentionally report lower numbers of infected	53.7	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	17.8	
		12.5 (4.3)
a. Doctors are paid to supposedly treat COVID-19, while hospitals are actually empty	18.5	
b. Hospitals are so overcrowded that patients sleep in toilets	27	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	5	

		2.5 (1.1)
a. COVID-19 vaccines contain only saline solution	12.5	
b. Pharmaceutical companies knowingly distribute harmful COVID-19 vaccines	35.9	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	4.5	
		9.3 (3.6)
a. People claiming in the media that they got vaccinated are all paid actors	6	
b. Members of the world's elite are getting vaccinated far from the public's eye	38.8	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	2.3	
		2.5 (1.1)
a. Coronavirus is a bioweapon manufactured for the mass depopulation of the planet.	43.8	
b. COVID-19 is nothing but a common cold whose consequences are intentionally exaggerated.	33.8	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	14.8	
		22.8 (11)
a. Coronavirus was planted into China by the Americans to damage the Chinese economy.	27.4	
b. China has manufactured this virus to conquer the world.	14.2	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	3.9	
		4.6 (1.1)
a. Virus has escaped in 2019 from the laboratory after decades of dangerous experiments; it is naive to believe it was accidentally transferred from animals	49.8	

b. This coronavirus has been circling in the human population for years, it's only now that the opportunity presented itself for that to finally be revealed

Co-occurrence threshold for independent beliefs (a x b)

38.1

19

27.4 (12.1)

*Note. The percentages reflect the percent of the sample that answered 3 or 4 on a 1 (definitely not true) to 4 (definitely true) scale. The percent of the sample that answered 4 on both items depicted in brackets. Co-occurrence calculated as a product of proportion for each belief.

The overall simultaneous acceptance of contradictory CTs was similar to the rate of acceptance in Study 1, with 42% of the sample finding at least one contradictory pair simultaneously true. Similarly to Study 1, simultaneous endorsement for all pairs was above the threshold for mutual exclusivity, and for all but two pairs above the threshold for independence.

Superficial information processing as a correlate of belief in contradictory COVID-19 CTs

Zero-order correlations between variables are depicted in Table 6. As in Study 1, we normalized the variables with the Rankit transformation (Solomon & Sawilovsky, 2009), but continue to report non-transformed descriptives and opt for non-parametric correlations, as pre-registered.

Replicating the findings in Study 1, participants endorsed close to one pair of contradictory CTs on average, and five pairs of more general contradictory beliefs measured by the doublethink scale, with 97% of the sample holding at least one pair of such contradictory beliefs.

Table 6

Means, standard deviations and Spearman's correlations (Study 2)

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6
1. BCCCT	0.81	1.16						
2. Doublethink	4.99	2.57	.36***					
3. Ontological confusions	2.77	0.69	.34***	.40***				
4. REI - Rational	3.6	0.8	-.16**	-0.09	-.12*			
5. REI - Experiential	3.8	0.82	.14*	.38***	.13*	-0.01		
6. Pseudo-profound bullshit receptivity	2.97	0.79	.17**	.24***	.23***	-0.04	0.11	
7. Digital literacy	5.13	0.98	-0.08	-0.11	-.12*	.37***	0.02	-.16**

*Note. BCCCT - belief in contradictory COVID-19 CTs. Correlations significant after Bonferroni-adjusting for all 21 correlations are printed in bold.

* indicates $p < .05$, ** indicates $p < .01$ and *** indicates $p < .001$

Belief in contradictory COVID-19 CTs was related to all measures in the expected direction (H1a - H1e), with the exception of digital literacy (H1f), where the zero-order correlation was non-

significant. Doublethink was, as expected, related to ontological confusions (H3a), intuitive thinking style (H3b) and bullshit receptivity (H3c), but not to rational thinking style (H3d) or digital literacy (H3e), contrary to our expectations.

Next, we ran a hierarchical forced entry regression analysis, with superficial processing measures as predictors of belief in contradictory COVID-19 CTs included in the first step, and adding doublethink in the second step to check whether it contributes to prediction over and above the other included predictors (Table 7).

Table 7

Hierarchical forced entry regression with belief in COVID-19 CTs as the outcome (Study 2)

	<i>B [95% CI]</i>	<i>S.E.</i>	β	<i>t</i>
Step 1				
Ontological confusions	0.234 [0.141, 0.328]	0.048	0.29	4.930***
REI - Rational	-0.143 [-0.262, -0.025]	0.06	-0.142	-2.379*
REI - Experiential	0.060 [-0.032, 0.153]	0.047	0.073	1.284
Pseudo-profound bullshit	0.102 [-0.016, 0.220]	0.06	0.1	1.698
Digital literacy	0.017 [-0.079, 0.113]	0.049	0.021	0.345
Step 2				
Ontological confusions	0.169 [0.072, 0.266]	0.049	0.209	3.418***
REI - Rational	-0.139 [-0.254, -0.023]	0.059	-0.138	-2.360*
REI - Experiential	0 [-0.095, 0.095]	0.048	0	-0.001
Pseudo-profound bullshit	0.069 [-0.047, 0.186]	0.059	0.068	1.169
Digital literacy	0.027 [-0.067, 0.121]	0.048	0.034	0.571
Doublethink	0.205 [0.101, 0.309]	0.053	0.248	3.873***

Note. B - unstandardized regression coefficient, S.E. - standard error for B, β - standardized regression coefficient

* indicates $p < .05$ and *** indicates $p < .001$

The model was significant in the first step ($F(5, 275) = 9.75, p < .001; R^2_{adj} = .135$), however, only ontological confusions and rational thinking style contributed to prediction in opposite directions. In the second step, the model was still significant ($F(6, 274) = 11.04, p < .001; R^2_{adj} = .177, \Delta R^2 = .042, p < .001$), with doublethink contributing an additional 4% of variance once all other predictors are accounted for (local effect size of $f^2 = 0.05$; H2). Both ontological confusions and rational thinking style contributed to prediction alongside doublethink.

As in Study 2, we also ran a SEM analysis that corroborated these results (Supplement B).

Analytical information processing as a correlate of belief in contradictory COVID-19 CTs

Given the relations of endorsement of contradictory COVID-19 CTs to the superficial information processing style, to gain a more fine-grained perspective on the underlying information processing style, next we focused on more specific cognitive abilities and competence-based measures of systematic analytical reasoning.

Cognitive reflection (Frederick, 2005) refers to the ability to override intuitive responses and reflect upon them to produce a correct answer to a question. There is empirical evidence that this ability is negatively related to endorsement of COVID-19 conspiracies (Alper et al., 2020; Stanley et al., 2020; Teovanović et al., 2020), and we aimed to explore whether it holds true for the even more normatively irrational tendency - endorsement of contradictory COVID-19 CTs. Another analytical ability, reasoning on belief-biased syllogisms (Evans, 2003) - suppressing prior beliefs about the truthfulness of the conclusion in a categorical syllogism and evaluating it purely based on its logical validity - was also previously negatively linked to conspiratorial beliefs (Šrol, 2021), so we included it in this study as well. Another potentially protective ability - statistical and numerical literacy (Cokely et al., 2012, Peters et al., 2006) was also already linked to less endorsement of CTs (Šrol, 2021), as well as to less susceptibility to COVID-19 misinformation (Rozenbeek et al., 2020). Finally, while not strictly a cognitive ability, actively open-minded thinking is a form of meta-belief about whether or not beliefs should change in light of new evidence. As such, it has been previously shown to be an important feature of analytical thinking, related to dismissing epistemically suspect beliefs in general (Pennycook et al., 2020), as well as COVID-19 unfounded beliefs, including CTs (Erceg et al., 2020) and less proneness to cognitive bias (Erceg et al., 2022). We expected this pattern to be replicated in relation to endorsement of contradictory conspiratorial beliefs.

Study 3

Aims and hypotheses

The aim of this study was to explore how different measures of analytical processing are related to belief in contradictory COVID-19 CTs. Additionally, as in previous studies, we wanted to test whether doublethink can contribute to the prediction on top of the other predictors, to contrast it to this particular predictor set as well.

We expected that cognitive reflection (H1a), actively open-minded thinking (H1b), syllogistic reasoning (H1c) and numeric literacy (H1d) would contribute negatively to the prediction of belief in contradictory conspiracy theories about the pandemic, while doublethink would contribute positively (H1e).

Additionally, in line with previous studies, we expected that doublethink would contribute to the prediction over and above all measures of analytical information processing style (H2).

The study and its hypotheses were preregistered as well: https://aspredicted.org/869_GTS.

Method

Measures

Cognitive reflection. We included the Cognitive Reflection Test (Frederick, 2005), consisting of three items (example item: *A bat and a ball cost 1100 din in total. The bat costs 1000 din more than the ball. How much does the ball cost?*). Participants answered by inputting a number, and the score was calculated as a sum of correct answers; $\alpha = .72$.

Actively open-minded thinking (Haran et al., 2013) was assessed using the short, 7-item version (example item: *“People should revise their beliefs in response to new information or evidence.”*), with participants indicating their agreement on a scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). The score is calculated as the mean of all items. The scale’s reliability was $\alpha = .59$.

Syllogistic reasoning was assessed using four categorical syllogisms that favor belief-biased reasoning (example item: *“All animals like water. Cats don’t like water. Conclusion: Cats are not animals.”*). Participants answer by indicating whether the conclusion is valid i.e. it follows from the two premises (*yes/no*). We calculated the score as a sum of correct answers; $\alpha = .77$.

Numeric and statistical literacy was assessed using the Berlin Numeracy Test (Cokely et al., 2012) which consists of 4 items (example item: *“Imagine we are throwing a five-sided die 50 times. On average, out of these 50 throws, how many times would this five-sided die show an odd number (1, 3 or 5)?”*) to which participants answer by inputting a number. The score is calculated as a sum of correct answers, with $\alpha = .65$.

Before conducting the study, we introduced smaller changes to the Belief in contradictory COVID-19 CTs scale. To update the scale, we omitted one pair of CTs due to its lack of relevance at this point in the pandemic (*“People claiming in the media that they got vaccinated are all paid actors”* and *“Members of the elite are getting vaccinated without the knowledge of the public.”*) and we pretested several pairs of more current contradictory CTs. In the final version, we included one pair that satisfied previously set thresholds for familiarity (>4) and logical incompatibility (>5) – *“The media is constantly going on about the pandemic, while the supposed virus that caused it hasn’t even been isolated.”* and *“The vaccines were developed so quickly that it’s clear that a lot has been known about the virus for a while”* ($M_{\text{familiarity}} = 4.38$, $M_{\text{incompatibility}} = 5.90$; $N = 21$).

Internal reliability of this new version of the belief in contradictory CTs scale was good ($\alpha = .68$, $GLB = .75$).

Doublethink ($\alpha = .72$, $GLB = .81$) was measured using the same scale as in Study 1 and 2. As before, there were no significant relations between the score on belief in COVID-19 contradictory theories and the time spent on the whole battery ($r = -.04$, $p = .582$) nor on the time spent on the scale itself ($r = -.04$, $p = .645$). Similarly, there was no correlation with doublethink and time spent on the scale itself ($r = .02$, $p = .779$; $r = -.01$, $p = .871$), and only a weak significant correlation with the total time spent on the whole battery ($r = -.16$, $p = .036$).

Sampling

We recruited a total of 179 participants who completed the questionnaires in full. As in previous studies, we based the minimum sample size needed ($N = 160$) to be able to detect a local

effect of doublethink of $f^2 = 0.066$ in hierarchical forced entry regression, with power 90% at alpha = .05 (see [preregistration](#)). We once again included a high threshold for careless responding, with five attention checks in total. Upon excluding those who failed one or more of the attention checks, the final sample consisted of a total of $N = 170$ participants (60% female; 38% male and 2% other/rather not say; average age was 47.52 (SD = 12.97)). Participation was once again not incentivized, and the average time for filling out the whole battery was 18 minutes.

Results

Endorsement of COVID-19 conspiracy theories

We again examined the endorsement of contradictory COVID-19 CTs first. The endorsement of pairs was somewhat lower than in previous two studies (Table 8).

Table 8
Percent of the sample (Study 3) that accepts individual conspiratorial items (the percent of the sample that finds both of the items in the pair true)

Items	% of the sample that thinks is true (answers 3-4)	% of the sample that thinks both are true at the same time (% that thinks both are fully true at the same time)
a. Coronavirus tests are rigged to show positive results	26.5	
b. Officials intentionally report lower numbers of infected	58.8	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	15.6	8.2 (2.9)
a. Doctors are paid to supposedly treat COVID-19, while hospitals are actually empty	18.8	
b. Hospitals are so overcrowded that patients sleep in toilets	27.6	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	5.2	5.9 (1)
a. COVID-19 vaccines contain only saline solution	6.5	
b. Pharmaceutical companies knowingly distribute harmful COVID-19 vaccines	37.1	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	2.4	

a. The vaccines were developed so quickly that it's clear that a lot has been known about the virus for a while.	46.5	
b. The media is constantly going on about the pandemic, while the supposed virus that caused it hasn't even been isolated.	31.2	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	14.5	26.5 (12.9)
a. Coronavirus is a bioweapon manufactured for the mass depopulation of the planet	37.1	
b. COVID-19 is nothing but a common cold whose consequences are intentionally exaggerated.	28.8	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	10.7	18.2 (5.3)
a. Coronavirus was planted into China by the Americans to damage the Chinese economy	21.8	
b. China has manufactured this virus to conquer the world	14.7	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	3.2	4.7 (1.2)
a. Virus has escaped in 2019 from the laboratory after decades of dangerous experiments; it is naive to believe it was accidentally transferred from animals	41.2	
b. The supposedly novel coronavirus has been circling in the human population for years, the opportunity presented itself for that to finally be revealed	28.2	
<i>Co-occurrence threshold for independent beliefs (a x b)</i>	11.6	17.6 (6.5)

**Note.* The percentages reflect the percent of the sample that answered 3 or 4 on a 1 (definitely not true) to 4 (definitely true) scale. The percent of the sample that answered 4 on both items depicted in brackets. Co-occurrence calculated as a product of proportion for each belief.

The overall simultaneous acceptance of contradictory CTs was also similar to the previous two studies, with still a substantial portion (41%) of the sample finding at least one contradictory pair simultaneously true. As in previous two studies, we observed evidence for this tendency in a non-trivial number of respondents: the simultaneous endorsement was above the threshold of mutual exclusivity for all contradictory pairs, and above the threshold of independent co-occurrence for all but one of the pairs.

Analytical processing as a correlate of belief in contradictory COVID-19 CTs

We again normalized the variables with the Rankit transformation (Solomon & Sawilovsky, 2009), but, as per preregistration, continue to report non-transformed descriptives and non-parametric correlations (Table 9).

On average, participants endorsed close to one pair of contradictory CTs, while also endorsing more than five pairs of more general contradictory beliefs from the doublethink scale.

Table 9

Means, standard deviations and Spearman's correlations (Study 3)

	M	SD	1	2	3	4	5
1. BCCCT	0.86	1.31					
2. Doublethink	5.31	2.63	.33***				
3. Actively open-minded thinking	5.6	0.84	-.37***	-.28***			
4. Cognitive reflection	1.26	1.18	-0.05	-.17*	.24**		
5. Syllogistic reasoning	1.35	1.43	-0.11	-.26***	0.15	.35***	
6. Numeric literacy	0.98	1.16	0.05	-0.15	.16*	.51***	.41***

**Note.* BCCCT - belief in contradictory COVID-19 CTs. Correlations significant after Bonferroni-adjusting for all 15 correlations are printed in bold.

* indicates $p < .05$, ** indicates $p < .01$ and *** indicates $p < .001$

In line with our expectations, doublethink related positively (H1e), and actively open-minded thinking negatively (H1b) to the prediction of belief in contradictory COVID-19 CTs. We did not observe the predicted negative correlations between endorsement of COVID-19 contradictory CTs and analytical competence measures: cognitive reflection (H1a), syllogistic reasoning (H1c) and numeric literacy (H1d).

Other interrelations between the variables were largely as expected: competence-based measures of analytical thinking were all moderately correlated, but were less consistently related to actively open-minded thinking. Doublethink was most strongly related to belief in COVID-19 contradictory CTs, but was also negatively related to actively open-minded thinking, syllogistic reasoning, and, albeit weakly, to cognitive reflection.

To test our final hypothesis (H2), we ran a hierarchical forced entry regression, with endorsement of COVID-19 contradictory CTs as the criterion, and actively open-minded thinking,

cognitive reflection, syllogistic reasoning and numeric literacy added as the predictors in the first step, and doublethink in the second step (Table 10).

Table

10

Hierarchical forced entry regression predicting belief in COVID-19 CTs (Study 3)

	<i>B [95% CI]</i>	<i>S.E.</i>	β	<i>t</i>
Step 1				
Actively open-minded thinking	-0.305 [-0.423, -0.187]	0.06	-0.378	-5.107***
Cognitive reflection	-0.002 [-0.168, 0.163]	0.084	-0.002	-0.026
Syllogistic reasoning	-0.110 [-0.268, 0.047]	0.08	-0.114	-1.385
Numeric literacy	0.143 [-0.024, 0.310]	0.085	0.15	1.686
Step 2				
Actively open-minded thinking	-0.252 [-0.369, -0.134]	0.06	-0.312	-4.229***
Cognitive reflection	0.008 [-0.151, 0.168]	0.081	0.009	0.104
Syllogistic reasoning	-0.048 [-0.204, 0.108]	0.079	-0.049	-0.608
Numeric literacy	0.142 [-0.019, 0.303]	0.082	0.149	1.736
Doublethink	0.083 [0.038, 0.128]	0.023	0.272	3.639***

Note. *B* - unstandardized regression coefficient, *S.E.* - standard error for *B*, β - standardized regression coefficient

* indicates $p < .05$ and *** indicates $p < .001$

The model was significant in the first step ($F(4, 165) = 7.809, p < .001; R^2_{adj} = .139$), with only actively open-minded thinking significantly contributing to the prediction. The model remained significant once doublethink was introduced ($F(5, 164) = 9.360, p < .001; R^2_{adj} = .198, \Delta R^2 = .059, p < .001$) and both actively open-minded thinking and doublethink contributed to the prediction. Doublethink explained an additional 6% of variance over and above the contribution of all four measures of analytical processing (local effect size of $f^2 = 0.08; H2$).

The SEM analysis is, as in previous studies, available in Supplement B.

General discussion

Across three studies, we explored the endorsement of belief in contradictory conspiracy theories about COVID-19. Pairs of CTs that were included were pretested for their familiarity and mutual exclusiveness. While previous studies have discussed belief in contradictory CTs by drawing from positive correlations between contradictory items (Wood et al., 2012), we treated it in a trait-like manner and measured individual differences in their endorsement (see also Lukić et al., 2019). Although not endorsed by the majority of respondents, contradictory CTs about the virus were supported by notable portions of three different samples. More importantly, this tendency was meaningfully related to other constructs, most markedly, doublethink - a general proneness to contradictory beliefs, irrespective of their content. Doublethink contributed to prediction even after accounting for preference for consistency and conspiratorial ideation (Study 1), a syndrome of traits indicative of superficial processing style - preference for intuitive and not rational thinking,

ontological confusion, receptivity for pseudo profound bullshit, and digital (i)literacy (Study 2), as well as a set of specific cognitive abilities reflecting the analytic processing style – cognitive reflection, syllogistic reasoning, numeracy, and actively open-minded thinking (Study 3).

The portions of the sample that simultaneously endorsed mutually incompatible beliefs were above the expected threshold of co-occurrence of independent beliefs, signaling that there is an underlying mechanism driving both contradictory beliefs, and further supporting the idea that higher order beliefs can generate different specific beliefs, even mutually incoherent ones. As previously suggested, contradictory CTs co-exist within the conspiratorial belief system due to its monological nature (Wood et al., 2012), where beliefs are organized hierarchically, with more general higher-order beliefs about a cover-up encompassing lower-order beliefs (Wood, 2017). This endorsement of mutually contradictory CTs could also explain why debunking of a specific theory about COVID-19 might prove to be ineffective – one CT will be easily replaced with another, even when their contents are highly incompatible (Miller, 2020). However, if we treat conspiracy mentality as a set of abstract beliefs on top of the pyramid (very general beliefs about powerful groups controlling important events in the world), our results show that even after accounting for it, doublethink still contributes to the prediction of belief in contradictory CTs. This implies that, while contradictory COVID-19 conspiratorial beliefs are largely defined by a more general tendency to perceive conspiracies everywhere, there is still a portion of variance that stems from a different general tendency to endorse contradictions, whether we interpret it as a lack of ability to spot them, or as a “high entropy thinking style” (for discussion about the nature of the construct see Petrović & Žeželj, 2021). Although it is possible that doublethink is adopted as a mechanism that sustains the incoherent conspiratorial beliefs within the belief system after they are acquired, it is also possible that this tendency allows the incoherent beliefs to enter the belief system in the first place (Petrović & Žeželj, 2021).

We also show that doublethink was predictive of contradictory conspiratorial thinking in a way that preference for consistency was not. What is more, preference for consistency was positively related to not only conspiratorial beliefs, but doublethink as well. This is not in line with our hypotheses which were embedded in the theoretical framework of preference for consistency (Cialdini et al., 1995). Yet, given that (a) this is a self-report measure, not a measure of actual consistency, and (b) it measures not only preference for consistency, but also the importance a person places on consistency, the construct might be more indicative of a person’s need to see the world and themselves in it as consistent than it is of a person actually being consistent in their beliefs and behavioral patterns. If conceptualized this way, it can be traced back to a tendency to perceive the world as non-random, which has repeatedly been tied to conspiratorial thinking (van Prooijen et al., 2018; Moulding et al., 2016). This might also explain why preference for consistency is positively related to it – those who want and need to appear inconsistent might be more prone to overlook existing inconsistencies in their own beliefs. The robustness of these relations, however, should still be independently replicated.

Besides replicating the contribution of doublethink to predicting endorsement of contradictory COVID-19 CTs, the results of our second study demonstrate that, even though it was related to all constructs indicative of superficial information processing, the two that accounted for the contribution of all others were ontological confusions and rational thinking style. This is in line with the notion that both intuitive and analytical information processing systems contribute to conspiratorial beliefs (Denovan et al., 2020; Petrović & Žeželj, 2021; Stojanov, 2015; Swami et al., 2014). While high experientiality generally encourages irrational thinking, simultaneously, high rationality can be a protective factor that leads to its suppression (Jokić & Purić, 2019), given that the two systems are independent (Epstein, 2014). The findings on ontological confusions are also in line with previous studies relating them to different types of irrational beliefs (Lindeman et al., 2015), and specifically

to conspiratorial beliefs (Rizeq et al., 2020). Moreover, those prone to superstitions tend to inaccurately ascribe attributes of living organisms to energy, thus making more ontological confusions. However, these vitalistic understandings of energy co-exist with scientific ones (Lindeman & Saher, 2007). Although the two types of knowledge are not logically contradictory, they are incompatible, implying that ontological confusions might lead to endorsement of inconsistent beliefs. This could explain their relation not only to COVID-19-related contradictory CTs, but to doublethink as well.

There was, however, less support for different analytical abilities as barriers to endorsement of COVID-19 conspiratorial beliefs. The only significant predictor, alongside doublethink, was actively open-minded thinking. This could potentially illustrate that a certain cognitive style, rather than ability, underpins endorsement of contradictory CTs, which is then reflected in self-assessment measures being more predictive of it than performance ones. Furthermore, endorsement of contradictory COVID-19 CTs might stem from the unwillingness of those prone to it to reevaluate their prior beliefs in light of newly adopted ones. The conspiratorial belief system could then be characterized by highly permeable borders, allowing for an easy adoption of new beliefs that suit the individual's belief system in general, but without updating prior ones. This way beliefs remain in the belief system, despite the fact that newly acquired beliefs contradict them. As doublethink was also most strongly correlated with actively open-minded thinking, future studies could explore how those high on inconsistent beliefs behave in belief updating tasks (Sharot et al., 2011). Given that there is a marked asymmetry in belief updating, where people are more likely to update their initial beliefs when they receive positively valued rather than negatively valued information, it is possible that, for example, those prone to doublethink do not exhibit selective updating, but rather tend to not update their beliefs in general.

Limitations and future studies

Since doublethink was the strongest predictor of belief in COVID-19 contradictory CTs in Study 2 and since our studies were purely correlational, follow up studies could focus on doublethink to tackle contradictory COVID-19 CTs. For example, nudging participants to actively look for inconsistencies in unrelated, non-conspiratorial material could lower their endorsement of contradictory COVID-19 CTs. Alternatively, the participants could be left to spot the inconsistencies in COVID-19 contradictory CTs on their own – they can be exposed to pairs of COVID-19 CTs they previously endorsed and subsequently asked to explain how both CTs could be true. Finally, debunking higher-order conspiracy beliefs can also lead to less endorsement of lower-order contradictory CTs. Even though dispelling such general beliefs might prove to be challenging, recent evidence suggests that it can be effective (Imhoff et al., 2020), albeit typically for a short-term. This is why building trust in public agents and developing critical thinking skills is necessary for eradication of conspiratorial beliefs.

Although measuring behavioral outcomes was outside the scope of this study, future studies should explore how the tendency to endorse contradictory COVID-19 conspiracies is related to pandemic health practices. Those susceptible to contradictory COVID-19 CTs could, for example, be particularly prone to simultaneously use recommended and pseudoscientific practices as protective measures against the virus. Similarly, while outside of the scope of this study given that our aim here was to explore whether people endorse contradictory COVID-19 CTs at all, future studies could focus on exploring if and how those with consistent conspiratorial beliefs differ from those that endorse contradictory conspiratorial beliefs or do not endorse conspiratorial beliefs at all.

Conclusions

To our knowledge, this is the first study that defined the endorsement of contradictory COVID-19 CTs in a trait-like manner - i.e. measured individual differences in this tendency. Nevertheless, we do not claim that this is a novel disposition, but a domain-specific manifestation of a more general tendency for doublethink. Our results suggest that the endorsement of this type of CTs is quite prevalent, and that those who are prone to contradictory CTs are more conspiratorial overall but also tolerate more inconsistencies in their beliefs, irrespective of its content; they also tend to rely less on rational, and more on intuitive thinking, are more receptive of pseudo-profound bullshit, more prone to ontological confusions and less likely to alter their prior beliefs in light of new evidence. This study offers further insight into the structure of conspiratorial belief system in the pandemic, and can help with tailoring recommendations for public health policies to combat conspiratorial beliefs and their consequences.

Chapter 3 References

- Alkali, Y. E., & Amichai-Hamburger, Y. (2004). Experiments in Digital Literacy. *CyberPsychology & Behavior*, 7(4), 421–429. <https://doi.org/10.1089/cpb.2004.7.421>
- Allington, D., Duffy, B., Wessely, S., Dhavan, N., & Rubin, J. (2020). Health-protective behaviour, social media usage and conspiracy belief during the COVID-19 public health emergency. *Psychological Medicine*, 1–7. <https://doi.org/10.1017/S003329172000224X>
- Alper, S., Bayrak, F., & Yilmaz, O. (2020). Psychological correlates of COVID-19 conspiracy beliefs and preventive measures: Evidence from Turkey. *Current Psychology*. <https://doi.org/10.1007/s12144-020-00903-0>
- Bertin, P., Nera, K., & Delouvée, S. (2020). Conspiracy Beliefs, Rejection of Vaccination, and Support for hydroxychloroquine: A Conceptual Replication-Extension in the COVID-19 Pandemic Context. *Frontiers in Psychology*, 11, 2471. <https://doi.org/10.3389/fpsyg.2020.565128>
- Bierwiazzonek, K., Kunst, J. R., & Pich, O. (2020). Belief in COVID-19 Conspiracy Theories Reduces Social Distancing over Time. *Applied Psychology: Health and Well-Being*, 12(4), 1270–1285. <https://doi.org/10.1111/aphw.12223>
- Bruder, M., Haffke, P., Neave, N., Nouripanah, N., & Imhoff, R. (2013). Measuring Individual Differences in Generic Beliefs in Conspiracy Theories Across Cultures: Conspiracy Mentality Questionnaire. *Frontiers in Psychology*, 4, 225. <https://doi.org/10.3389/fpsyg.2013.00225>
- Cialdini, R. B., Trost, M. R., & Newsom, J. T. (1995). Preference for consistency: The development of a valid measure and the discovery of surprising behavioral implications. *Journal of Personality and Social Psychology*, 69(2), 318–328. <https://doi.org/10.1037/0022-3514.69.2.318>
- Cokely, E. T., Galesic, M., Schulz, E., Ghazal, S., & Garcia-Retamero, R. (2012). Measuring risk literacy: The Berlin Numeracy Test. *Judgment and Decision Making*, 7(1), 25–47. <http://journal.sjdm.org/11/11808/jdm11808.pdf>
- Denovan, A., Dagnall, N., Drinkwater, K., Parker, A., & Neave, N. (2020). Conspiracist beliefs, intuitive thinking, and schizotypal facets: A further evaluation. *Applied Cognitive Psychology*, 34(6), 1394–1405. <https://doi.org/10.1002/acp.3716>
- DiStefano, C., & Morgan, G. B. (2014). A Comparison of Diagonal Weighted Least Squares Robust Estimation Techniques for Ordinal Data. *Structural Equation Modeling: A Multidisciplinary Journal*, 21(3), 425–438. <https://doi.org/10.1080/10705511.2014.915373>
- Epstein, S. (2014). *Cognitive-experiential theory: An integrative theory of personality*. Oxford University Press.
- Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive–experiential and analytical–rational thinking styles. *Journal of Personality and Social Psychology*, 71(2), 390–405. <https://doi.org/10.1037/0022-3514.71.2.390>

- Erceg, N., Galić, Z., & Bubić, A. (2022). Normative responding on cognitive bias tasks: Some evidence for a weak rationality factor that is mostly explained by numeracy and actively open-minded thinking. *Intelligence*, *90*, 101619. <https://doi.org/10.1016/j.intell.2021.101619>
- Erceg, N., Ružojčić, M., & Galić, Z. (2020). Misbehaving in the Corona crisis: The role of anxiety and unfounded beliefs. *Current Psychology*. <https://doi.org/10.1007/s12144-020-01040-4>
- Evans, J. St. B. T. (2003). In two minds: Dual-process accounts of reasoning. *Trends in Cognitive Sciences*, *7*(10), 454–459. <https://doi.org/10.1016/j.tics.2003.08.012>
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford University Press.
- Fonseca, R., Blascovich, J., & Garcia-Marques, T. (2014). Challenge and threat motivation: Effects on superficial and elaborative information processing. *Frontiers in Psychology*, *5*, 1170. <https://doi.org/10.3389/fpsyg.2014.01170>
- Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, *19*(4), 25–42. <https://doi.org/10.1257/089533005775196732>
- Goertzel, T. (1994). Belief in conspiracy theories. *Political Psychology*, *15*(4), 731. <https://doi.org/10.2307/3791630>
- Hart, J., & Graether, M. (2018). Something's going on here: Psychological predictors of belief in conspiracy theories. *Journal of Individual Differences*, *39*(4), 229–237. <https://doi.org/10.1027/1614-0001/a000268>
- Imhoff, R., Dieterle, L., & Lamberty, P. (2021). Resolving the puzzle of conspiracy worldview and political activism: Belief in secret plots decreases normative but increases nonnormative political engagement. *Social Psychological and Personality Science*, *12*(1), 71–79. <https://doi.org/10.1177/1948550619896491>
- Imhoff, R., & Lamberty, P. (2020). A bioweapon or a hoax? The link between distinct conspiracy beliefs about the coronavirus disease (COVID-19) outbreak and pandemic behavior. *Social Psychological and Personality Science*, *11*(8), 1110–1118. <https://doi.org/10.1177/1948550620934692>
- Lazić, A., & Žeželj, I. (2021). A systematic review of narrative interventions: Lessons for countering anti-vaccination conspiracy theories and misinformation. *Public Understanding of Science*, 09636625211011881. <https://doi.org/10.1177/09636625211011881>
- Levinson, D. J., & Sanford, R. N. (1944). A scale for the measurement of anti-Semitism. *The Journal of Psychology*, *17*(2), 339-370. <https://doi.org/10.1080/00223980.1944.9917200>
- Lewandowsky, S., & Cook, J. (2020). *The Conspiracy Theory Handbook*. Available at <http://sks.to/conspiracy>
- Li, C.-H. (2016). The performance of ML, DWLS, and ULS estimation with robust corrections in structural equation models with ordinal variables. *Psychological Methods*, *21*(3), 369–387. <https://doi.org/10.1037/met0000093>

- Lindeman, M., & Aarnio, K. (2007). Superstitious, magical, and paranormal beliefs: An integrative model. *Journal of Research in Personality*, 41(4), 731–744. <https://doi.org/10.1016/j.jrp.2006.06.009>
- Lindeman, M., & Saher, M. (2007). Vitalism, purpose and superstition. *British Journal of Psychology*, 98(1), 33–44. <https://doi.org/10.1348/000712606X101808>
- Lindeman, M., Svedholm-Häkkinen, A. M., & Lipsanen, J. (2015). Ontological confusions but not mentalizing abilities predict religious belief, paranormal belief, and belief in supernatural purpose. *Cognition*, 134, 63–76. <https://doi.org/10.1016/j.cognition.2014.09.008>
- Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the Relationship Between Conspiracy Theories, Paranormal Beliefs, and Pseudoscience Acceptance Among a University Population: Relationship between unwarranted beliefs. *Applied Cognitive Psychology*, 28(5), 617–625. <https://doi.org/10.1002/acp.3042>
- Lukić, P., Žeželj, I., & Stanković, B. (2019). How (ir)rational is it to believe in contradictory conspiracy theories? *Europe's Journal of Psychology*, 15(1), 94–107. <https://doi.org/10.5964/ejop.v15i1.1690>
- Miller, J. M. (2020). Do COVID-19 Conspiracy Theory Beliefs Form a Monological Belief System? *Canadian Journal of Political Science*, 53(2), 319–326. <https://doi.org/10.1017/S0008423920000517>
- Milošević Đorđević, J., Žeželj, I., & Đurić, Ž. (2021). Beyond general political attitudes: Conspiracy mentality as a global belief system predicts endorsement of international and local conspiracy theories. *Journal of Social and Political Psychology*, 9(1), 144–158. <https://doi.org/10.5964/jspp.5609>
- Pennycook, G., Cheyne, J., Barr, N., Koehler, D., & Fugelsang, J. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making*, 10, 549–563.
- Pennycook, G., McPhetres, J., Bago, B., & Rand, D. G. (2021). Beliefs about COVID-19 in Canada, the U.K., and the U.S.A.: A novel test of political polarization and motivated reasoning. *Personality and Social Psychology Bulletin*, 01461672211023652.
- Peters, E., Västfjäll, D., Slovic, P., Mertz, C. K., Mazzocco, K., & Dickert, S. (2006). Numeracy and Decision Making. *Psychological Science*, 17(5), 407–413. <https://doi.org/10.1111/j.1467-9280.2006.01720.x>
- Petrović, M. B., & Žeželj, I. (2021). Thinking inconsistently: Development and validation of an instrument for assessing proneness to doublethink. *European Journal of Psychological Assessment*, 1015-5759/a000645. <https://doi.org/10.1027/1015-5759/a000645>
- Rizeq, J., Flora, D. B., & Toplak, M. E. (2020). An examination of the underlying dimensional structure of three domains of contaminated mindware: Paranormal beliefs, conspiracy beliefs, and anti-science attitudes. *Thinking & Reasoning*, 1–25. <https://doi.org/10.1080/13546783.2020.1759688>
- Romer, D., & Jamieson, K. H. (2020). Conspiracy theories as barriers to controlling the spread of COVID-19 in the U.S. *Social Science & Medicine*, 263, 113356. <https://doi.org/10.1016/j.socscimed.2020.113356>

- Roozenbeek, J., Schneider, C. R., Dryhurst, S., Kerr, J., Freeman, A. L. J., Recchia, G., van der Bles, A. M., & van der Linden, S. (2020). Susceptibility to misinformation about COVID-19 around the world. *Royal Society Open Science*, 7(10), 201199. <https://doi.org/10.1098/rsos.201199>
- Sharot, T., Korn, C. W., & Dolan, R. J. (2011). How unrealistic optimism is maintained in the face of reality. *Nature Neuroscience*, 14(11), 1475–1479. <https://doi.org/10.1038/nn.2949>
- Solomon, S. R., & Sawilowsky, S. S. (2009). Impact of Rank-Based Normalizing Transformations on the Accuracy of Test Scores. *Journal of Modern Applied Statistical Methods*, 8(2), 448–462. <https://doi.org/10.22237/jmasm/1257034080>
- Stanley, M. L., Barr, N., Peters, K., & Seli, P. (2020). Analytic-thinking predicts hoax beliefs and helping behaviors in response to the COVID-19 pandemic. *Thinking & Reasoning*, 1–14. <https://doi.org/10.1080/13546783.2020.1813806>
- Stoica, C. A., & Umbreş, R. (2021). Suspicious minds in times of crisis: Determinants of Romanians' beliefs in COVID-19 conspiracy theories. *European Societies*, 1–16. <https://doi.org/10.1080/14616696.2020.1823450>
- Stojanov, A. (2015). Reducing conspiracy theory beliefs. *Psihologija*, 48(3), 251–266. <https://doi.org/10.2298/PSI1503251S>
- Sutton, R. M., & Douglas, K. M. (2020). Agreeing to disagree: Reports of the popularity of Covid-19 conspiracy theories are greatly exaggerated. *Psychological Medicine*, 1–3. <https://doi.org/10.1017/S0033291720002780>
- Swami, V., & Barron, D. (2020). Analytic Thinking, Rejection of Coronavirus (COVID-19) Conspiracy Theories, and Compliance with Mandated Social-Distancing: Direct and Indirect Relationships in a Nationally Representative Sample of Adults in the United Kingdom. PsyArXiv. <https://doi.org/10.31219/osf.io/nmx9w>
- Swami, V., Coles, R., Stieger, S., Pietschnig, J., Furnham, A., Rehim, S., & Voracek, M. (2011). Conspiracist ideation in Britain and Austria: Evidence of a monological belief system and associations between individual psychological differences and real-world and fictitious conspiracy theories: Conspiracist ideation. *British Journal of Psychology*, 102(3), 443–463. <https://doi.org/10.1111/j.2044-8295.2010.02004.x>
- Swami, V., Voracek, M., Stieger, S., Tran, U. S., & Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition*, 133(3), 572–585. <https://doi.org/10.1016/j.cognition.2014.08.006>
- Teovanović, P., Lukić, P., Zupan, Z., Lazić, A., Ninković, M., & Žeželj, I. (2020). Irrational beliefs differentially predict adherence to guidelines and pseudoscientific practices during the COVID-19 pandemic. *Applied Cognitive Psychology*, 35(2), 486–496. <https://doi.org/10.1002/acp.3770>
- Toplak, M. E., West, R. F., & Stanovich, K. E. (2014). Assessing miserly information processing: An expansion of the Cognitive Reflection Test. *Thinking & Reasoning*, 20(2), 147–168. <https://doi.org/10.1080/13546783.2013.844729>

- UNICEF (2017). *Znanje, stavovi i prakse u vezi sa imunizacijom dece u Srbiji*. [Knowledge, attitudes and practices on immunization of children in Serbia]. <https://www.unicef.org/serbia/media/9226/file/Znanje,%20stavovi%20i%20prakse%20.pdf>
- van Mulukom, V., Pummerer, L., Alper, S., Bai, H., Cavojava, V., Farias, J. E. M., Kay, C.S., Lazarevic, L.B., Lobato, E. J. C., Marinthe, G., Pavela Banai, I., Šrol, J., & Žeželj, I. (2022). Antecedents and consequences of COVID-19 conspiracy beliefs: a rapid review of the evidence. *Social Science & Medicine*, 114912.
- van Prooijen, J.-W., Douglas, K. M., & De Inocencio, C. (2018). Connecting the dots: Illusory pattern perception predicts belief in conspiracies and the supernatural: Illusory pattern perception. *European Journal of Social Psychology*, 48(3), 320–335. <https://doi.org/10.1002/ejsp.2331>
- Wood, M. J. (2017). Conspiracy suspicions as a proxy for beliefs in conspiracy theories: Implications for theory and measurement. *British Journal of Psychology*, 108(3), 507–527. <https://doi.org/10.1111/bjop.12231>
- Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and alive: beliefs in contradictory conspiracy theories. *Social Psychological and Personality Science*, 3(6), 767–773. <https://doi.org/10.1177/1948550611434786>
- World Health Organization (n.d.). *Infodemic*. https://www.who.int/health-topics/infodemic#tab=tab_1
- Zimmer, C., Gorman, J., & Mueller, B. (2021, May 27). Scientists Don't Want to Ignore the 'Lab Leak' Theory, Despite No New Evidence. *The New York Times*. <https://www.nytimes.com/2021/05/27/health/wuhan-coronavirus-lab-leak.html>

Chapter 3 Supplementary information

Supplement A

Belief in Contradictory Conspiracy Theories Scale

Pair 1

- a. America planted the coronavirus in China to weaken their economic growth, but that backfired on them.
- b. China clearly made the virus in order to establish world domination.

Pair 2

- a. It's no wonder that after decades of dangerous experiments the virus finally escaped from the lab in 2019 – no one believes that it was accidentally transferred from animals.
- b. The supposedly novel coronavirus has been circling in the human population for years, but was just now conveniently revealed.*

Pair 3

- a. There's now plenty of evidence that the coronavirus tests are rigged to show positive results.
- b. The officials are intentionally hiding the fact that the numbers of infected are much higher than those reported.

Pair 4

- a. Doctors are paid to supposedly treat the infected, and yet all the hospitals are empty.
- b. The fact that the hospitals are so overcrowded that patients sleep in toilets is being hidden from the public.

Pair 5

- a. The coronavirus is a powerful bioweapon made for the mass depopulation of the planet.
- b. COVID-19 is nothing more than a common cold whose consequences are intentionally exaggerated.

Pair 6

- a. COVID-19 vaccines contain only saline solution.
- b. The pharmaceutical industry is well aware of the dangers of COVID-19 vaccines and yet insists on distributing them.

Pair 7[†]

- a. The vaccines were developed so quickly that it's clear that a lot has been known about the virus for a while.
- b. The media is constantly going on about the pandemic, while the supposed virus that caused it hasn't even been isolated.

**Before Study 3, this item was worded slightly differently – instead of “the supposedly novel*

coronavirus” it said “this coronavirus”.

**This pair was only administered in Study 3*

Items omitted from the final scale

- a. It is clear that masks have no effect on health whatsoever, but are still imposed on us for profit.
- b. Wearing a mask leads to carbon dioxide intake, which damages the lungs – more work for the pharmaceutical industry!

- Omitted from the final score in Study 2 due to its potentially non-contradictory interpretation

- a. The people in the media who are claiming they are getting COVID-19 jabs are actually all paid actors – no one was even vaccinated against the virus.
- b. The members of the elite are all getting vaccinated far from the public's eye.

- Omitted in Study 3 due to its lack of relevance in the later stages of the pandemic

Items from the scale construction phase that were excluded in the pilot study due to their non-contradictory/unfamiliar nature - pretest data is available on [OSF](#)

- a. The coronavirus was produced to ensure the tracking of the world population through vaccination.
- b. The coronavirus was produced to finally solve the overpopulation issue.

$M_{\text{familiarity}} = 5.7$; $M_{\text{contradictory}} = 3.3$

- a. If you've heard Bill Gates' speech from a few years back about the threat of a pandemic and the significance of vaccines, you know that he is behind the coronavirus pandemic.
- b. It's no wonder there's a coronavirus pandemic when it is well known that Chinese authorities have been opening dangerous biochemical labs for years.

$M_{\text{familiarity}} = 4.9$; $M_{\text{contradictory}} = 4.6$

- a. The pandemic was orchestrated by the pharmaceutical industry.
- b. The pharmaceutical industry has overstated the pandemic only to shamelessly profit off of it.

$M_{\text{familiarity}} = 5.5$; $M_{\text{contradictory}} = 2.0$

- a. Refugees are paid to spread the coronavirus.
- b. The pandemic was orchestrated as a smokescreen for large-scale settlement of refugees.

$M_{\text{familiarity}} = 2.7$; $M_{\text{contradictory}} = 4.8$

- a. It will become clear that the pandemic was only a smokescreen for the final reckoning with the agents of the deep state.
- b. If you know anything about the deep state it is clear that that's who decided to cause this pandemic.

$M_{\text{familiarity}} = 3.0$; $M_{\text{contradictory}} = 5.8$

- a. This whole coronavirus thing is a mere media spin and a fabrication.
- b. The disease attributed to the coronavirus is actually a consequence of radiation spread by the 5G network.

$M_{\text{familiarity}} = 5.9$; $M_{\text{contradictory}} = 4.4$

- a. The globalists intentionally halted the vaccine approval process to ensure the pandemic does not end.
- b. Mass vaccinations are a key step in the globalists' plan for world domination.

$M_{\text{familiarity}} = 3.3$; $M_{\text{contradictory}} = 6.1$

Supplement B

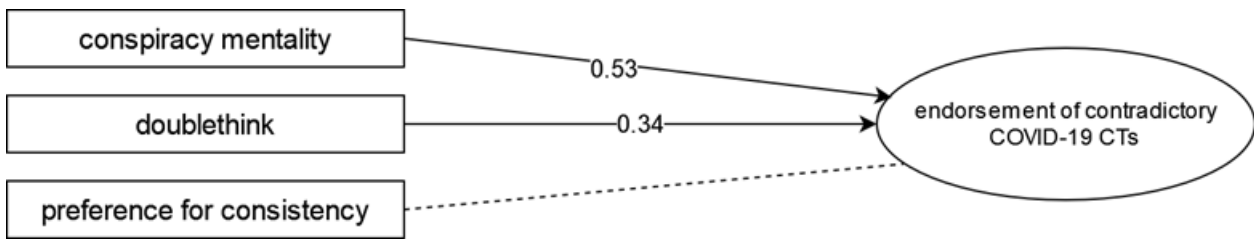
SEM analyses

Study 1

To further disentangle the unique contributions of general tendency for consistency and doublethink to the prediction of belief in contradictory COVID-19 CTs, and to more accurately model it as a latent variable, we fitted the model depicted in Figure 1. Given that the COVID-19 contradictory CT items are binary, we used the three-stage robust diagonally weighted least squares estimator (DiStefano & Morgan, 2014). The model fit the data well ($\chi^2(41, N=290) = 59.929, p = .028$; $\chi^2/df = 1.46$; CFI = 0.95, TLI = 0.96; RMSEA = 0.04 (90% CI 0.01-0.06), close fit test non-significant ($p = .767$)). As expected, all CT items loaded on the latent dimension, and both conspiracy mentality and doublethink contributed to the prediction of endorsement of COVID-19 contradictory CTs, explaining 53% of the variance. Preference for consistency did not contribute to prediction.

Figure 1

SEM model with the unique effect of conspiracy mentality, preference for consistency and doublethink on COVID-19 contradictory CT endorsement (Study 1)



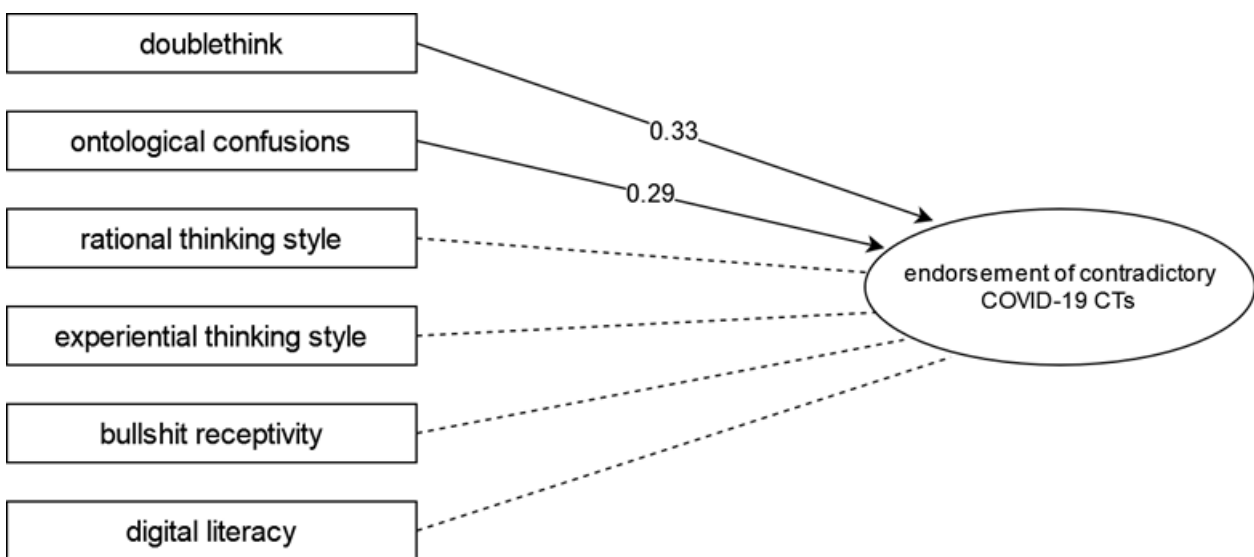
Note. The coefficients represented are the standardized regression coefficients. Dashed lines indicate non-significant paths. Observed variables are represented by rectangles, and latent with ovals. We have omitted the item-level variables for CTs for a clearer outline of the model.

Study 2

As in Study 1, we again tested a SEM model to explore the unique effects of the superficial information processing variables on the endorsement of contradictory COVID-19 CTs (Figure 2), using a three-stage robust diagonally weighted least squares estimator. The model fitted the data well ($\chi^2(50, N=281) = 60.994, p = .137$; CFI = 0.95, TLI = 0.98; RMSEA = 0.03 (90% CI 0-0.05)), close fit test non-significant ($p = .951$). All CT items loaded on the latent dimension, however, only doublethink and ontological confusions had significant effects on it. The model explained 35% of variance of the latent variable.

Figure 2

SEM model of effect of superficial information processing variables on contradictory COVID-19 CT endorsement (Study 2)



Note. The coefficients represented are the standardized regression coefficients. Dashed lines indicate non-significant paths. Observed variables are represented by rectangles, and latent with ovals. We have omitted the item-level variables for CTs for a clearer outline of the model.

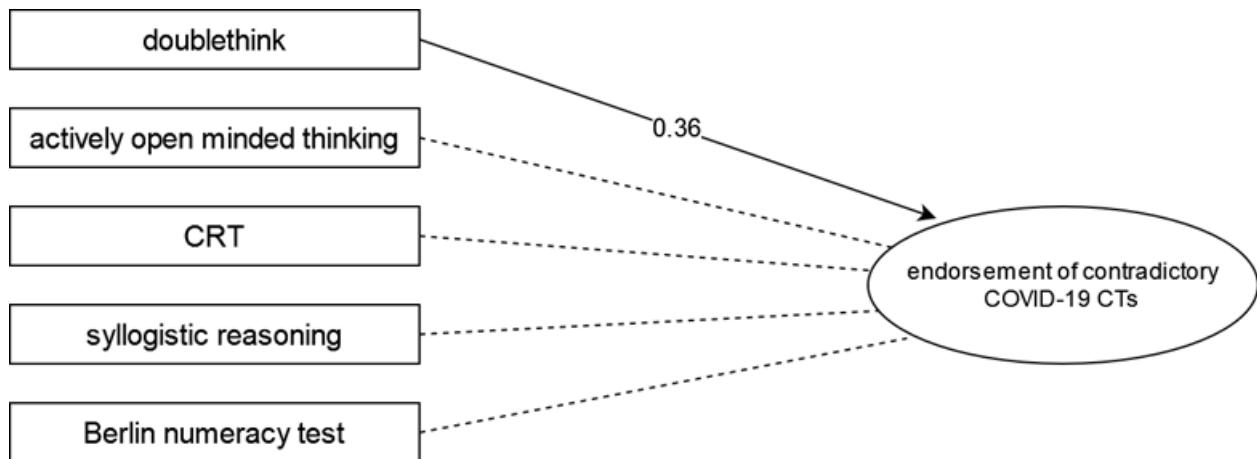
Study 3

Finally, for Study 3, we again tested a SEM model to explore the unique effects of the analytical information processing variables on the endorsement of contradictory COVID-19 CTs, using a three-stage robust diagonally weighted least squares estimator ($\chi^2(44, N=170) = 38.789, p = .694$; CFI = 1.00, TLI = 1.01; RMSEA = 0.00 (90% CI 0-0.04)), close fit test non-significant ($p =$

.982)). All CT items loaded on the latent dimension, and only doublethink had significant effects on it. The model explained 31% of variance of the endorsement of contradictory COVID-19 items.

Figure 3

SEM model of effect of analytical information processing variables on contradictory COVID-19 CT endorsement (Study 3)



Note. The coefficients represented are the standardized regression coefficients. Dashed lines indicate non-significant paths. Observed variables are represented by rectangles, and latent with ovals. We have omitted the item-level variables for CTs for a clearer outline of the

Chapter 4

Paper 4 | Inconsistent yet unyielding: Persistence of contradictory beliefs and strategies for their reconciliation

This is the accepted, peer-reviewed version of the paper. Please cite as:

Petrović, M. B., & Žeželj, I. (2025). Inconsistent yet unyielding: Persistence of contradictory beliefs and strategies for their reconciliation. *British Journal of Psychology*, 00, 1–26.
<https://doi.org/10.1111/bjop.70002> (Published online 2025)

ARTICLE

Inconsistent yet unyielding: Persistence of contradictory beliefs and strategies for their reconciliation

Marija B. Petrović  | Iris Žeželj 

LIRA Lab, Department of Psychology,
Faculty of Philosophy, University of Belgrade,
Belgrade, Serbia

Correspondence

Marija B. Petrović, Čika Ljubina 18-20, Belgrade
11000, Serbia.

Email: marija.petrovic@f.bg.ac.rs

Funding information

Ministry of Education, Science and Technological
Development of the Republic of Serbia, Grant/
Award Number: 451-03-47/2023-01/200163

Abstract

To better understand how inconsistent beliefs persist and whether the tendency to endorse them (labelled doublethink) is malleable, we conducted five preregistered studies and a qualitative follow-up (total $N = 1635$ Serbian participants). We first found and replicated that doublethink was robustly related to both a more intuitive, superficial information processing style and a lack of ability to spot contradictions ($r = .20$ and $r = .21$, $p_s < .001$). We next tested three progressively more direct interventions to reduce doublethink, all unsuccessful – the first one tried to increase sensitivity to contradictions in irrelevant material, the second pushed respondents to reconcile pairs of newly provided inconsistent beliefs and the third made them cross-reference their own inconsistent beliefs. When asked to elaborate on their inconsistencies in semi-structured interviews, respondents did not evaluate them negatively, but instead employed circumvention strategies – attributing incompatibility to the response format or diluting the content of the claims. The most commonly used strategy was to rely on adding additional logical conditions to the beliefs (in 34% of the cases). Although these strategies could reflect rational belief safeguarding mechanisms, they also might allow for moral relativization, double standards or incompatible expectations from others (e.g. posing irreconcilable standards for minority groups).

KEYWORDS

doublethink, inconsistent beliefs, overcoming contradictions, superficial information processing, thinking styles

Limitations and future research

Different experimental manipulations did not reduce doublethink, probably due to the lack of negative evaluation of endorsement of contradiction. Future interventions could focus on attaching negative evaluations to it – for example, through highlighting the consequences of moral relativization or double standards that could arise from doublethink. Additionally, as syllogistic reasoning was the dominant correlate of doublethink in Study 1, interventions that tackle superficial information processing (e.g. debiasing interventions (Isler & Yilmaz, 2023) or interventions directly correcting errors in syllogistic reasoning) could be an avenue for future research.

Given the design of our studies, we focused on contradictory beliefs that have already been formed. Future studies could apply a more process-oriented perspective by exploring how contradictory beliefs are formed and maintained via longitudinal designs.

In our last study, we faced people with their contradictory beliefs and asked them to elaborate on how those two beliefs could be simultaneously true. The strategies they used to reconcile inconsistencies might not occur spontaneously. Future studies could thus ask people to elaborate on their beliefs right after they answer how much they endorse them. Afterwards, their explanations for contradictory claims can be examined to evaluate whether the same strategies for reconciliation of beliefs are used without prompt. Future research could also draw from the fact that one strategy for resolving contradictions that emerged was attributing inconsistency to the response format. It is true that we use a 4-point scale and then classify people as either agreeing or disagreeing with a claim even though they might only partially agree with it. They, however, still have an option to be consistent in their partial agreements. Even if we consider this a flaw in the measure, the measure still repeatedly shows robust, meaningful relations to a range of convergent constructs. Researchers could nevertheless consider using a binary format, albeit its potential problem with lower dispersion. We find that mixed method studies like ours are useful precisely for complementing quantitative ones, e.g. by demonstrating how participants perceive giving answers on standard psychological scales.

Finally, researchers could also directly explore the hypothesized negative outcomes related to doublethink in the intergroup domain, including whether endorsement of contradictory beliefs is related to having inconsistent standards for different groups or irreconcilable expectations from, for example, minority groups.

CONCLUSIONS

The results of five preregistered studies and a set of in-depth interviews suggest that inconsistency within belief systems is neither as uncommon nor as undesirable as it is often assumed. We found that people rarely correct contradictory beliefs, even when prompted to cross-reference them. Instead, they employ various strategies to maintain these conflicting views. Potential negative outcomes of doublethink (e.g. double standards), however, highlight the need for alternative strategies to mitigate it.

AUTHOR CONTRIBUTIONS

Marija B. Petrović: Conceptualization; investigation; methodology; validation; visualization; writing – review and editing; formal analysis; data curation; writing – original draft. **Iris Žeželj:** Conceptualization; methodology; supervision; writing – review and editing; writing – original draft.

ACKNOWLEDGEMENTS

This work is part of Marija Petrović's PhD thesis entitled “Consistently inconsistent: Predictivity and validity of doublethink” at the University of Belgrade, supervised by Dr Iris Žeželj.

FUNDING INFORMATION

This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (451-03-47/2023-01/200163).

Inconsistent yet unyielding: Persistence of contradictory beliefs and strategies for their reconciliation

Marija B. Petrović¹ & Iris Žeželj¹

¹LIRA lab, Department of Psychology, Faculty of Philosophy, University of Belgrade

Corresponding author: Marija B. Petrović, Čika Ljubina 18-20, Belgrade, 11000, Serbia email: marija.petrovic@f.bg.ac.rs

Acknowledgments: This work is part of Marija Petrović's PhD thesis entitled "Consistently inconsistent: Predictivity and validity of doublethink" at the University of Belgrade, supervised by Dr Iris Žeželj.

Author contributions: Marija B. Petrović (Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Validation, Visualization, Writing - original draft, Writing - review & editing); Iris Žeželj (Conceptualization, Methodology, Supervision, Writing - original draft, Writing - review & editing)

Conflicts of interest: Both authors declare no conflicts of interest.

Funding: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia [451-03-47/2023-01/200163].

Ethics: This research was approved by the Institutional review board at the Department of Psychology, Faculty of Philosophy, University of Belgrade (Protocols #2022-053 and #2023-006)

Materials, data and analysis scripts are available for all six studies on OSF: <https://osf.io/8phqz/>

Preregistrations

Study 1.1: https://aspredicted.org/PDJ_FFH; Study 1.2: <https://aspredicted.org/dgwy-hmzm.pdf>;
Study 2.1: https://aspredicted.org/8WG_B8L; Study 2.2: https://aspredicted.org/MDF_JXP; Study
2.3: https://aspredicted.org/BDD_CPC

Abstract

To better understand how inconsistent beliefs persist and whether the tendency to endorse them (labeled doublethink) is malleable, we conducted five preregistered studies and a qualitative follow-up (total N = 1635 Serbian participants). We first found and replicated that doublethink was robustly related to both more intuitive, superficial information processing style and lack of ability to spot contradictions ($r = .20$ and $r = .21$, $ps < .001$). We next tested three progressively more direct interventions to reduce doublethink, all unsuccessful - the first one tried to increase sensitivity to contradictions in irrelevant material, second pushed respondents to reconcile pairs of newly provided inconsistent beliefs; third made them cross-reference their own inconsistent beliefs. When asked to elaborate on their inconsistencies in semi-structured interviews, respondents did not evaluate them negatively, but instead employed circumvention strategies - attributing incompatibility to the response format or diluting the content of the claims. The most commonly used strategy was to rely on adding additional logical conditions to the beliefs (in 34% of the cases). Although these strategies could reflect rational belief safeguarding mechanisms, they also might allow for moral relativization, double standards or incompatible expectations from others (e.g. posing irreconcilable standards for minority groups).

Word count: 194

Keywords: inconsistent beliefs, doublethink, thinking styles, superficial information processing, overcoming contradictions

Inconsistent yet unyielding: How contradictory beliefs resist interventions and strategies that enable it

“Oh so you just found those where I was contradictory? Well, I am still contradictory, I stand by it.”

-Study 3 participant

Introduction

If someone claimed, for example, at one point that voting should be obligatory for everyone, but five minutes later that they knew someone who should clearly not be allowed to vote, we would be quick to point out this inconsistency. We might even use it as a proxy for irrationality, dismissing their arguments based on it. Seminal psychological research (Heider, 1946; Festinger, 1957) and philosophical theorizing (e.g. Thagard, 2007) suggests that people should be uncomfortable with inconsistencies in their beliefs and behaviors, and strive to alter them to be congruent. We have, despite this, and across several studies, shown that people can easily simultaneously endorse contradictory beliefs (labeled *doublethink* as in Orwell’s *1984*; Petrović & Žeželj, 2021; 2023; 2024). In line with this empirical evidence, some authors argue that consistency might be cognitively impossible, given the amount of resources required to check every single belief for consistency with prior ones or with incoming evidence (Simon & Holyoak, 2002; Sommer et al., 2022). Moreover, as belief revision happens as to minimize belief change (i.e. upholding as much of previous beliefs as possible), this often means sacrificing consistency (Schwind et al., 2022). Some logic systems, such as paraconsistent (or non-monotonic) ones even allow for such reasoning from inconsistent premises (Pfeifer & Kleiter, 2005; Schwind et al., 2022). Inconsistency then might not be so rare within our belief system, but rather its default state (Sommer et al., 2022). Nevertheless, there are stable individual differences in the endorsement of inconsistent beliefs (Petrović & Žeželj, 2021; 2023; 2024). Illuminating the processes shaping doublethink can help design interventions to reduce it. This might be particularly relevant given its stable positive correlation to different irrational beliefs - e.g., conspiratorial (Petrović & Žeželj, 2021; 2023; 2024), superstitious (Petrović & Žeželj, 2022; 2024), paranormal (Petrović & Žeželj, 2024), magical health (Knežević et al, 2024; Lazarević et al, 2023; Petrović & Žeželj, 2024), and extrasensory perception beliefs (Knežević et al., 2024), all of which have documented detrimental behavioral consequences (e.g. Biddelstone et al., 2020; Imhoff et al., 2021; Lazarević et al., 2023; Knežević et al., 2024; Tam & Chan 2023; Taschner et al., 2022).

Across five preregistered studies and a qualitative follow-up, we first tested whether doublethink is related to (a) a lack of ability to spot inconsistencies, and (b) information processing style, while controlling for two relevant executive functions. Next, we tested three interventions to reduce doublethink, each one progressively more direct in prompting participants to spot and correct inconsistent beliefs. We started with instructing the participants to look for inconsistencies in neutral material in the first intervention, expecting that sensitivity will transfer to more sensitivity to contradictions in beliefs as well. We relied on initial evidence of similar inconsistency spotting training improving children's comprehension skills (Wassenburg et al., 2015), although its effectiveness for restoring belief coherence has not been tested previously. There were, however, reasons to expect transfer from training in neutral domains to personal beliefs. For example, generating unrelated counterfactuals transfers to more belief revision in response to conflicting evidence (Rose et al., 2024), while counterfactual debiasing in one domain transfers to unrelated domains as well (e.g., Galinsky et al., 2000; Hirt et al., 2004).

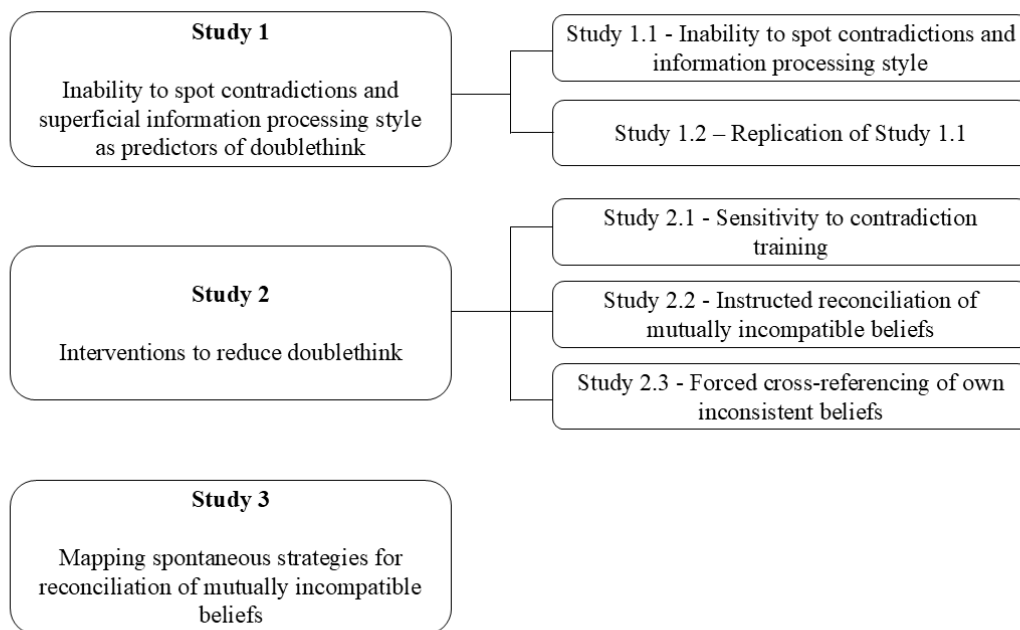
In an attempt to draw participants’ attention to the fact contradictory beliefs are irreconcilable, in the second intervention we asked them to explain how two *newly provided* (unfamiliar) contradictory beliefs can be true, with the expectation that their inability to do so will lead them to reconsider their own beliefs in the same manner. While crafting this intervention we were inspired by the research on the illusion of explanatory depth (Rozenblit & Keil, 2002) and construal-level theory (Alter et al., 2010; Trope & Liberman, 2010) in which participants are posed a set of questions (e.g. “why” or “how”) and, typically, face their inability to generate meaningful answers.

In the last intervention, we directly prompted participants to cross-reference *their own* inconsistent beliefs and later retested their endorsement. This was supposed to make specific beliefs simultaneously accessible in memory and lead to their revision (Sommer et al., 2022).

Finally, through semi-structured interviews, we explored which strategies people employ to avoid revising their contradictory beliefs, i.e. to reconcile them and allow them to coexist. Figure 1 shows the overview of the current research.

Figure 1

Overview of studies



Lack of ability, particular thinking style or both?

The tendency to endorse incompatible beliefs can be a manifestation of a general, more superficial information processing style (e.g. Fonseca et al., 2014; Petrović & Žeželj, 2023) - one that entails a quicker, less thorough, more intuitive approach to information processing. Previous findings suggest that doublethink is related to less cognitive reflection (Petrović & Žeželj, 2023) and less success in syllogistic reasoning tasks (Petrović & Žeželj, 2023), as well as more intuitive and less analytical (Petrović & Žeželj, 2021), and less actively open-minded thinking (Knežević et al., 2024; Petrović & Žeželj, 2023; 2024). It is also related to higher need for cognitive closure (Petrović & Žeželj, 2024). This pattern of relations seems to suggest a disheveled thinking style, but,

paradoxically, also a belief system that is rigid and resistant to change. Endorsement of contradictory beliefs can, however, also be a result of a person's inability to spot them. That means people higher on doublethink would be less successful in spotting logically incompatible statements when exposed to them.

Doublethink's relation to superficial information processing has previously been extensively examined - however, its relationship to the ability to spot inconsistencies has not. While its relation to superficial processing could be rendered obsolete once the ability to spot inconsistencies is taken into account, it is also possible that both indicate an insensitivity to contradictions - one stemming from an inability to spot them, and the other from a more lenient, superficial processing. Thus, superficial information processing and the ability to spot inconsistencies could represent independent but partially overlapping tendencies that both contribute to doublethink. The question does not have to be either/or - doublethink could entail both to different degrees and at different points of belief formation.

Finally, if indeed this inability to spot inconsistencies is driving the endorsement of contradictory beliefs, it would be important to disentangle it from deficits in more basic information processing ability. We argue that doublethink is tied to a more specific skill of spotting contradictions which cannot be reduced to deficits in cognitive ability i.e. that this relation will persist even when general cognitive ability is accounted for. We here explored two executive functions, which are regulatory mechanisms of multiple cognitive processes (Miyake et al., 2000). We first controlled for the updating executive function, which requires monitoring incoming information and updating the existing information in memory accordingly (Friedman & Miyake, 2017; Miyake et al., 2000). Doublethink could be driven by its underperformance, as less successful updating could be allowing for contradictory beliefs to be adopted into and persist within the belief system. Next, we controlled for shifting - an executive function assessing the participants' ability to switch between two tasks (Miyake et al., 2000), usually considered an indicator of cognitive flexibility (Diamond, 2013). Failures in shifting could allow for compartmentalization of beliefs and make cross-referencing between them more difficult.

Study 1.1 - Inability to spot contradictions and superficial information processing style as predictors of doublethink

Methods

Aims and hypotheses

In this study we explored how doublethink is related to a. sensitivity to inconsistency (i.e. the ability to spot contradictions) in neutral material, and b. thinking styles, as well as whether thinking styles have an independent contribution to the prediction of doublethink, over and above the contribution of the ability to spot inconsistencies. To represent different aspects of the superficial information processing style, we included measures of rational and intuitive thinking style, as well as a measure of syllogistic reasoning. We also controlled for an aspect of cognitive ability by including a measure of the updating executive function. The aim was to account for the potential contribution of deficits in cognitive processing to doublethink, and isolate the unique contribution of the ability to spot inconsistencies as a distinct skill, separate from more general executive functioning processes. Moreover, we wanted to explore if superficial information processing style has an additional contribution to prediction, over and above this specific ability.

We expected doublethink to be positively related to intuitive thinking style (H1a), but negatively to syllogistic reasoning (H1b), rational thinking style (H1c), ability to spot inconsistencies (H1d), and executive function of updating (H1e). We also expected (H2) that at least one measure of thinking style (rational and intuitive style, and syllogistic reasoning) will contribute to the prediction of doublethink over and above the two ability measures: spotting inconsistencies and updating.

All hypotheses, analyses and sampling plan were preregistered: https://aspredicted.org/PDJ_FFH. The analyses for all studies except Study 3 were done in R version 4.4.1 (R Core Team, 2021).

Materials

Doublethink was assessed with the Proneness to doublethink scale (Petrović & Žeželj, 2021). The scale measures the tendency to adopt incompatible beliefs and consists of 11 pairs of contradictory beliefs (e.g. *Some people are essentially irreparable* and *Every single person is capable of growth and change*). Participants indicated their agreement with each statement individually using a 4-point scale (1 - *completely disagree*; 4 - *completely agree*). The score is calculated by adding up all the pairs where the participants agreed (marked 3 or 4 on the scale) with both items in the pair, and thus ranges from 0 to 11. The scale is administered in two separate blocks of 11 items (one from each pair), alongside two buffer items per block, which are not scored.

Updating was measured using the N-back task (adapted from Friedman et al., 2008). The task consisted of one practice block where the participants are given feedback and four task blocks - one 1-back task, two 2-back tasks and one 3-back task. In each block, participants were instructed to press the left mouse button once the letter matched the letter that was presented one, two or three letters back (“yes” response). There were a total of eight “yes” responses in each block. They were instructed to otherwise not react (“no” response). The blocks consist of 25 letters that are presented in a sequence, each for 1000 ms, with an inter-stimulus interval of 500 ms. The score was calculated as the proportion of correct responses (yes and no) across all four blocks.

Sensitivity to inconsistencies was measured via a task that was developed for the purpose of the study and it consisted of a 218 word long made-up coffee advert. The advert had a total of five pairs of contradictions embedded in it (e.g. at one point it claimed that *All of the coffee beans are gathered by hand* but later on boasted that *Thanks to a specially developed technology, none of the beans have to be gathered by hand*). The participants were instructed to read the text carefully, because they will be asked questions about it later on, but were not told that it contained contradictions. The advert was presented for 105 seconds (to allow participants to read through it only once, based on the number of words and the average time of reading of three pretesters). To ensure that the participants read the text, we included three comprehension checks (two closed-ended and one open-ended) on the content of the advert (e.g. *Which type of coffee bean was used for the advertised product?*). After they read the text, the participants were then asked if they noticed any contradictions, and to list all contradictory pairs they noticed. The score was calculated as a sum of pairs and thus ranged from 0 to 5. The text is available in Supplement S1 on OSF: <https://osf.io/8phqz/>.

To assess thinking style we first used a short, 8-item version (Jokić et al., 2023) of the Rational-Experiential Inventory (Pacini & Epstein, 1999). The scale consists of two 4-item subscales: rational (e.g. *I enjoy intellectual challenges.*) and experiential (e.g. *I like to rely on my intuitive impressions.*). The participants indicated their agreement with the items on a 1 (*definitely not true of myself*) to 5 (*definitely true of myself*) scale, and the score was calculated by taking the mean of all items on each of the subscales.

As another measure of thinking style, we used a syllogistic reasoning task (Teovanović et al., 2015) with four categorical syllogisms that promote belief-biased reasoning, where the logically correct answer conflicts with a belief-based one (e.g. *All mammals can walk. Whales are mammals. Conclusion: Whales can walk*). Participants answered by indicating whether the conclusion is valid i.e. whether it follows from the two premises using a binary scale (yes/no). The score was calculated as the sum of correct answers on all four syllogisms - lower score indicated more reliance on intuitive cues when assessing the validity of the conclusion.

Sociodemographics. The participants reported their gender (female, male, other/would rather not say) as well as their age.

Procedure

All participants first provided their informed consent, after which they filled out the doublethink scale with the syllogistic reasoning task in the middle of the two doublethink blocks. Afterwards, they were presented with the sensitivity to inconsistency task, followed by the N-back task and the measure of thinking styles. They provided their sociodemographic data at the end. The survey was administered via the SoSci Survey platform (Leiner, 2023).

Sampling

We based the sample size needed to be able to detect an effect size of $f^2 = 0.066$ in hierarchical regression with power = 0.90 (see preregistration for details - https://aspredicted.org/PDJ_FFH). The planned sample size was $N = 217$, however, since the participants were recruited online through Facebook and Twitter ad campaigns, the sample size was a little larger due to the continued recruitment online. A total of 244 participants from Serbia completed the questionnaire in full. As per preregistration, we excluded participants who failed one or more of the three attention checks ($n = 7$), as well as participants that answered two or more of the three comprehension checks incorrectly ($n = 3$). The final sample size thus consisted of 234 participants, 57.3% were women, 42.3% men, while the rest indicated the *other/rather not respond* option. The mean age of participants was 45.84 ($SD = 12.15$).

Results

Relations between doublethink, cognitive abilities and thinking styles

Table 1 details the descriptive statistics of all measures, as well as Spearman correlations (as per preregistration). The participants were relatively unsuccessful in spotting contradictions, on average finding just under two out of the five. Similarly, they endorsed just under four out of eleven pairs of contradictory beliefs.

Table 1

Means, standard deviations, skewness, kurtosis, reliability (on diagonal) and Spearman correlations

Variable	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>Ku</i>	1	2	3	4	5	
1. Doublethink (0-11)	3.79	2.09	0.54	-0.06	<i>0.66</i>					
2. N-back/updating (0-1)	0.74	0.08	-0.75	2.57	-.16*	/				
3. Sensitivity to contradictions (0-5)	1.94	1.23	0.26	-0.44	-.20**	0.11	/			
4. Rational thinking style (1-5)	3.95	0.71	-0.51	-0.2	-0.01	-0.02	0.11	<i>0.72</i>		
5. Experiential thinking style (1-5)	3.49	0.88	-0.08	-0.5	.16*	-0.07	-0.11	-0.03	<i>0.79</i>	
6. Syllogistic reasoning (0-4)	1.59	1.38	0.29	-1.09	-.34***	.30***	.19**	.14*	-.20**	<i>0.71</i>

Note. *M*, *SD*, *Sk* and *Ku* are used to represent mean, standard deviation, skewness and kurtosis, respectively. We report Cronbach's alpha on the diagonal, except for doublethink, where we report the Greatest Lower Bound on the diagonal (see Petrović & Žeželj, 2022 for details).

Correlations significant at least at $p < .05$ after Holm correction are printed in bold.

* indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$

In line with our predictions, doublethink was related positively to intuitive thinking style (H1a), but negatively to syllogistic reasoning (H1b), sensitivity to inconsistencies (H1d) and updating (H1e). The only expected relation we did not observe was between doublethink and rational thinking style (H1c). The strongest correlation was between doublethink and syllogistic reasoning.

To test our final hypothesis (H2), we ran a hierarchical forced entry regression predicting doublethink, with updating and sensitivity to inconsistency as the predictors in the first step, and rational/intuitive thinking styles and syllogistic reasoning as additional predictors in the second step (Table 2).

Table 2*Regression results using doublethink as the criterion*

Predictor	<i>b</i>	<i>beta</i>	<i>Beta</i> 95% CI [LL, UL]	Fit	Difference
<i>Step 1</i>					
Sensitivity to inconsistency	-0.32**	-0.19	[-0.32, -0.06]	$R^2 = .054^{**}$	
N-back/updating	-3.82*	-0.14	[-0.26, -0.01]		
<i>Step 2</i>					
Sensitivity to inconsistency	-0.24*	-0.14	[-0.26, -0.02]	$R^2 = .134^{***}$	$\Delta R^2 = .080^{***}$
N-back/updating	-1.73	-0.06	[-0.19, 0.06]		
Rational thinking style	0.13	0.04	[-0.08, 0.16]		
Experiential thinking style	0.17	0.07	[-0.05, 0.20]		
Syllogistic reasoning	-0.45***	-0.29	[-0.42, -0.17]		

Note. A significant *b*-weight indicates the beta-weight is also significant (represented in bold). *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$

The model was significant in the first step, with both sensitivity to contradiction and updating contributing to the prediction. More importantly, as expected (H2), the model was significant in the second step as well, with syllogistic reasoning, alongside sensitivity to inconsistency, contributing negatively to prediction. Syllogistic reasoning (as a representative of the tendency to reflect and suppress intuitive answers) was the best predictor, while updating had no significant contribution when other predictors were taken into account.

As a robustness check, we also re-ran all of the analysis with normalized skewed variables (see Supplement S2 on OSF for details: <https://osf.io/8phqz/>), with the pattern of the results remaining the same.

Study 1.2 - A replication of the relation between inability to spot contradictions, superficial information processing style and doublethink

Given that the participants had to rely on their memory in the sensitivity to inconsistency task, and the close relation of updating and working memory capacity (Wilhelm et al., 2013), we replicated the findings of Study 1.1, while ensuring to eliminate these memory confounds.

To do so, we altered the sensitivity to inconsistency task so that the answers were given on the same page where the task was presented, allowing participants to answer while simultaneously reading the text. Additionally, instead of relying on the updating executive function, we assessed shifting.

We, as in Study 1.1 expected doublethink to be positively related to intuitive thinking (H1a), but negatively to syllogistic reasoning (H1b), rational thinking style (H1c), sensitivity to inconsistencies (H1d), and better shifting (H1e). We also again expected (H2) that at least one measure of thinking style (rational and intuitive style, and syllogistic reasoning) will contribute to the prediction of doublethink over and above the two ability measures: sensitivity to inconsistencies and shifting. The study was again preregistered: <https://aspredicted.org/dgwy-hmzm.pdf>

Methods

We used the same measures assessing doublethink, thinking styles and syllogistic reasoning as in the previous study.

Shifting was assessed using the local-global task (Purić, 2014; adapted from Miyake et al. 2000). The task consists of Navon figures, where a global figure is made up of smaller, local figures. In this version of the task, geometric figures were used (a circle, an X, and a triangle), so that the stimulus was, for example, a circle made up of triangles (see example on OSF: <https://osf.io/8phqz/>). The participant's task is to react to either the global or the local figures (depending on the instruction) by indicating how many lines the figure has (i.e. by pressing 1 for the circle, 2 for the X and 3 for the triangle). The task consisted of three blocks - in the first block, all figures were in red and the participant's task was to react to the global figure; in the second all figures were in black and the task was to react to the local figures, while the final block was the shifting block where the participants had to react to either the global and the local figures, depending on the color of the stimuli. The first two blocks had 30 trials (stimuli were presented randomly), while the shifting block had 60 (26 shifting blocks (i.e. a trial in which the participants had to shift to a different task from the previous trial) and 34 non-shifting blocks (where the task was the same as in the previous trials), all presented in a fixed, pseudorandomized order). The participants had 1500 ms to respond, and they got feedback if they made a mistake ("Error! Please try to answer more accurately") or took too long to answer ("Please try to respond more quickly"). The stimuli set consisted of six red (or global) figures and six black (or local) figures. The difference in accuracy or reaction time (RT) between shifting and non-shifting blocks reflects the executive function of shifting. Given that both reaction time and accuracy scores can have issues with reliability and validity (Hughes et al., 2013), and that each one does not take into account the other, we calculated an alternative binning score (Draheim et al., 2016; Hughes et al., 2013). This score takes into account both accuracy and RT and the trade off between them. Using the scores from the final block, we first calculated the mean RT for accurate non-shifting trials, and then subtracted it from the individual RT for each individual accurate shifting trial. The scores are then rank ordered into deciles and assigned a bin value ranging from 1 to 10. The fastest 10% of scores are assigned a value of 1 while the slowest 10% of scores are assigned a value of 10. Inaccurate shifting trials are assigned a score of 20. Bin scores are then added up, with lower scores indicating

(1) a smaller difference in RT between non-shifting and shifting trials and (2) less mistakes i.e. better shifting overall.

Sensitivity to inconsistency task was the same content-wise as in Study 1.1, however, instead of participants having to list the contradictions after being shown the text and having to rely on their memory, the boxes for listing the contradictions were presented on the same page. The task was presented for a total of 171 seconds (the time that the text was presented in Study 1.1 plus the median time it took participants to write their answers in Study 1.1) after which the participants were transferred automatically to the next page. To make sure the participants engaged with the task, they were not allowed to get to the next page before the 171 seconds lapsed.

Sampling

The sample size was based on an a priori power analysis (see preregistration for details - <https://aspredicted.org/dgwy-hmzm.pdf>). We based the needed sample size ($N = 304$) as to be able to detect the smallest correlation from Study 1.1 ($r = .16$) with a power of .80 and $\alpha = .05$. This also allowed us to detect an effect of $f^2 = 0.05$ with power of .90 in the hierarchical regression, which was smaller than the effect found in Study 1.1. A total of 324 Serbian participants completed the study in full - as the participants were again recruited using Facebook ads, the sample size was a bit larger than planned. As per preregistration, we filtered out the participants that failed any of the attention checks ($n = 13$ for the first, $n = 2$ for the second, and $n = 37$ for the third attention check), so they did not finish the study and did not count towards the initial total sample. In line with the preregistration, we also excluded participants who had an RSI above 2 ($n = 5$). We also removed $n = 4$ participants that had no recorded shifting data. This means that the final sample was $N = 315$. The sample consisted of 55.2% women, 43.8% men, while the rest of the participants chose the *other/rather would not say* option. The mean age of the participants was 50.54 ($SD = 11.89$).

Results

Relations between doublethink, cognitive abilities and thinking styles

Table 3 details the descriptive statistics of all measures, as well as correlations. The participants were again, despite the task changes, relatively unsuccessful in spotting contradictions, on average finding just under two out of the five. Similarly to Study 1.1, they endorsed four out of eleven pairs of contradictory beliefs.

Table 3*Means, standard deviations, skewness, kurtosis, reliability (on diagonal) and correlations*

Variable	<i>M</i>	<i>SD</i>	<i>Sk</i>	<i>Ku</i>	1	2	3	4	5	
1. Doublethink (0-11)	4	2.34	0.35	-0.42	<i>0.76</i>					
2. Shifting	400.25	56.92	-0.38	0.53	-0.01	<i>0.65</i>				
3. Sensitivity to contradictions (0-5)	1.84	1.43	0.34	-0.87	-.21***	-.17**	/			
4. Rational thinking style (1-5)	3.95	0.71	-0.51	-0.2	0.02	0	0.07	<i>0.75</i>		
5. Experiential thinking style (1-5)	3.87	0.75	-0.29	-0.44	.15**	-0.01	-0.07	0.08	<i>0.76</i>	
6. Syllogistic reasoning (0-4)	1.57	1.41	0.39	-1.04	-.43***	-.13*	.30***	.22***	-.13*	<i>0.72</i>

Note. *M*, *SD*, *Sk* and *Ku* are used to represent mean, standard deviation, skewness and kurtosis, respectively. We report Cronbach's alpha on the diagonal, except for doublethink, where we report the Greatest Lower Bound on the diagonal (see Petrović & Žeželj, 2022 for details). Correlations significant at least at $p < .05$ after Holm correction are printed in bold. * indicates $p < .05$. ** indicates $p < .01$. *** indicates $p < .001$.

In line with our predictions, doublethink was related positively to intuitive thinking style (H1a), but negatively to syllogistic reasoning (H1b) and sensitivity to inconsistencies (H1d). Unexpectedly, it was not related to either rational thinking style (H1c) or shifting ability (H1e). The strongest correlation was, as in Study 1.1 between doublethink and syllogistic reasoning, and both the pattern and the magnitude of the relations were almost identical to that of Study 1.1.

To test our final hypothesis (H2), we ran a hierarchical forced entry regression predicting doublethink, with shifting and sensitivity to inconsistency as the predictors in the first step, and rational/intuitive thinking styles and syllogistic reasoning as additional predictors in the second step (Table 4).

Table 4*Regression results using doublethink as the criterion*

Predictor	<i>b</i>	<i>beta</i>	Beta 95% CI [LL, UL]	Fit	Difference
<i>Step 1</i>					
Sensitivity to inconsistency	-0.36***	-0.22	[-0.33, -0.11]		
Shifting	0	-0.05	[-0.16, 0.06]		
				$R^2 = .041***$	
<i>Step 2</i>					
Sensitivity to inconsistency	-0.17	-0.1	[-0.21, 0.00]		
Shifting	0	-0.09	[-0.19, 0.01]		
Rational thinking style	0.37*	0.12	[0.02, 0.22]		
Experiential thinking style	0.2	0.07	[-0.03, 0.17]		
Syllogistic reasoning	-0.71***	-0.43	[-0.54, -0.32]		
				$R^2 = .211***$	$\Delta R^2 = .170***$

Note. A significant *b*-weight indicates the beta-weight is also significant (represented in bold). *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. * indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$

The model was significant in the first step, with only sensitivity to contradiction contributing to the prediction. As expected (H2), the model was significant in the second step as well, with syllogistic reasoning contributing negatively to prediction. Rational thinking style also contributed to prediction, a likely statistical artefact, given its non-significant zero order correlation to doublethink. Syllogistic reasoning was again the best predictor, with sensitivity to contradictions being non-significant when other predictors were taken into account.

As a robustness check, we also re-ran all of the analysis with normalized skewed variables (see Supplement S3 on OSF for details: <https://osf.io/8phqz/>), with the pattern of the results remaining largely the same.

The ability to spot inconsistencies was robustly related to doublethink across two studies (albeit syllogistic reasoning was a stronger predictor). Since we had empirical evidence to expect the transfer effect (Rose et al., 2024) and an easily implementable procedure to train this ability, we next examined whether the relation between doublethink and sensitivity to inconsistency could be employed to experimentally reduce doublethink.

Study 2.1 - Sensitivity to contradiction training

Methods

Aims and hypotheses

In this study we tested whether instructing participants to look for inconsistencies in neutral material might make the inconsistencies in their own beliefs more salient so they would consequently be less prone to endorse them.

We expected that that proneness to doublethink would decrease after the experimental manipulation in the experimental group, while there would be no changes in proneness to doublethink in the control group. As in the previous study, we preregistered the hypothesis and the design, alongside the analyses and the sampling plan - https://aspredicted.org/8WG_B8L.

Design and experimental manipulation

The study followed a 2 (experimental manipulation: control vs experimental; between subjects) \times 2 (time point: pretest vs posttest; within-subjects) mixed design. The participants were randomly assigned to either the control or the experimental group, and all participants filled out the doublethink scale at two points - before and after the manipulation. The participants in the experimental group had a contradiction spotting task. They first went through an exercise, where they were presented with a short 104 word text on jellyfish, in which a total of two pairs of contradictions were embedded (e.g., “Jellyfish are the first animals with a nervous system” and later on “...the jellyfish’s closest relative is the sea cucumber, which is the first animal with a nervous system”). Before the text was presented, they were told that there were several inconsistencies or pairs of contradictory information within the text and that their task was to try and spot as many of them as possible. The participants provided their answers on the same page where the text was presented, to avoid the confounding effect of them having to rely on their memory. On the next page, they were shown the text again, with the contradictions highlighted, alongside the answers they provided. Afterwards, they moved on to the main task, with the same instructions and structure. The main task text was about the platypus and it was longer, with 197 words and a total of five pairs of contradictions (e.g., “Its ears have no auricles and they cannot be closed” and “...closing and opening their ears”). The participants listed the contradictions below the text again. For the main task, the participants had two minutes to work through the page and were not allowed to progress further until those two minutes had lapsed (Supplement S4: <https://osf.io/8phqz/>).

The participants in the control group were shown a text that was identical to the main task text of the experimental group, but without embedded contradictions (Supplement S4). They were instructed to read the text and to single out the most important information from it. The box for providing information was shown below the text, like in the experimental group. The participants also had two minutes to work through the task, and the text was of the same length as the main text in the experimental group.

Measures

Buffer scale. We used the Brief Rosenberg Self-Esteem Scale (B-RSES; Monteiro et al., 2022) as a buffer between the two doublethink blocks of items. The scale consists of five items (e.g., *I feel I do have much to be proud of.*). Participants answer using a 7-point scale (1 = *Completely Disagree*; 7 = *Completely Agree*), and the score is calculated by taking the mean of all five items. The participants filled out the distractor scale twice (once in the pretest and once in the posttest).

Doublethink was measured as in the previous study, and we collected the same *sociodemographic* data.

Procedure

The survey was hosted on the SoSci Survey platform (Leiner, 2023). The participants first provided their informed consent, after which they all filled out the doublethink scale and the buffer scale. The participants were then randomly assigned either to the control or the experimental condition, and went through the experimental manipulation. They then filled out the doublethink scale again, alongside the buffer scale, and provided sociodemographic data.

Sampling

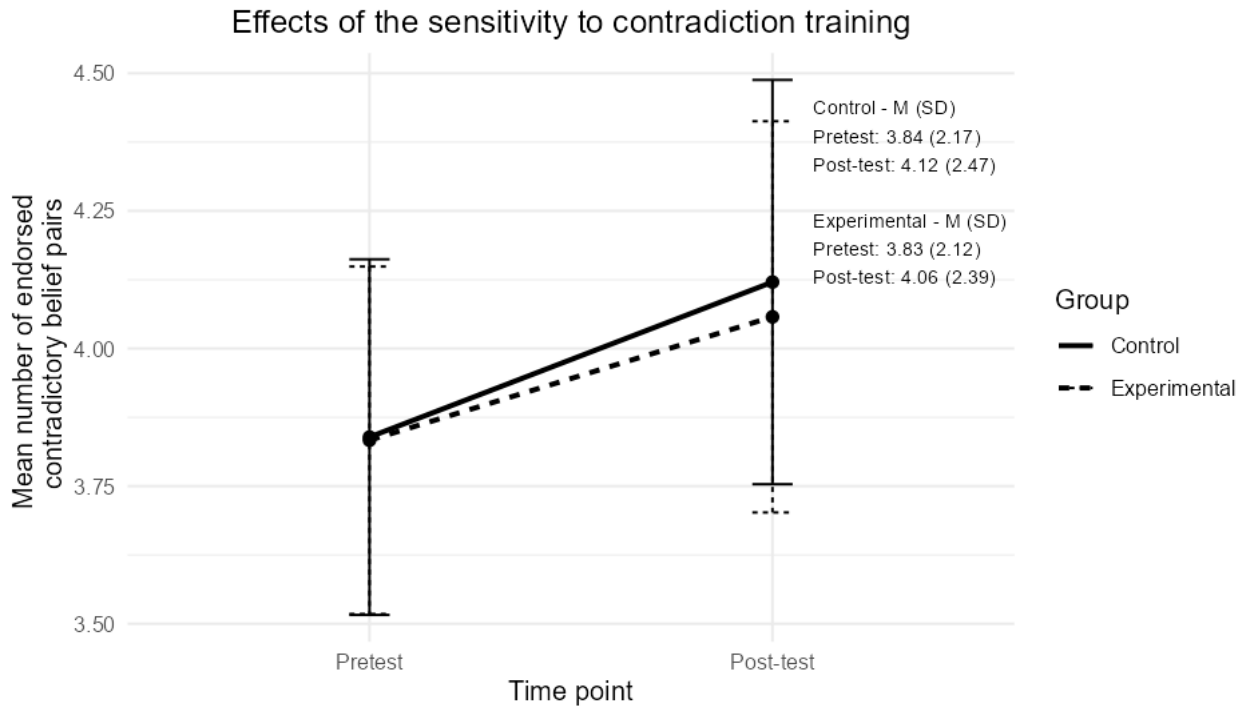
The sample size was again based on an a priori power analysis ($N = 346$), to be able to detect a small to medium effect size ($d = .35$) with power = 0.90 (see preregistration - https://aspredicted.org/8WG_B8L). A total of 381 Serbian participants were recruited online via snowballing and Facebook and Twitter ads. The higher number of participants is again due to the sampling strategy. As per preregistration, we excluded participants who failed one of the two attention checks ($n = 22$), as well as those who finished the survey too quickly (as indicated by the relative speed index (RSI, Leiner, 2019) i.e., participants who had an $RSI > 2$, suggesting that they finished the survey two times faster than the median participant ($n = 11$)). This left us with a total sample of $N = 348$ ($n = 174$ in each experimental condition). The sample consisted of 64.1% women, 34.5% men, while the rest of the participants chose the *other/rather would not say* option. The mean age of the participants was 45.04 ($SD = 12.51$).

Results

Figure 2 outlines the mean doublethink scores across experimental groups and time points. There was no significant difference between the two groups on doublethink in the pretest ($t(345.81) = 0.025$, $p = .980$), while the correlation between doublethink scores in the pretest and the posttest was $r = .80$ ($p < .001$).

Figure 2

Doublethink score across experimental groups and time points with 95% confidence intervals - Study 2.1



To test our hypothesis, we ran a two-way mixed ANOVA, with experimental manipulation as the between-subjects factor and time point as the within-subjects factor. Crucially, and contrary to our expectations (H1), there was no significant interaction between the two factors - $F(1, 346) = 0.132, p = .717$, suggesting that the manipulation did not reduce doublethink. Moreover, we found no main effect of experimental manipulation ($F(1, 346) = 0.022, p = .882$), while there was a significant main effect of time point ($F(1, 346) = 10.192, p = .002$) i. e. doublethink was slightly higher in the posttest regardless of the experimental group.

As a robustness check, we also checked for outliers by calculating the median absolute deviation ($3 \times \text{MAD}$) from the median score (Leys et al., 2013). We performed the outlier analysis on the scores within each group (i.e. control and experimental) and for the pretest and posttest scores separately. However, no outliers were detected.

Since we found no effect of inconsistency sensitivity training on doublethink, we next employed a more direct intervention, one that focused specifically on relation between beliefs i.e. one that encouraged more thorough information processing and spurred participants on to scrutinize their belief structure.

Study 2.2 - Instructed reconciliation of incompatible beliefs

In this study, we tested if, after being instructed to explain how two newly supplied and unfamiliar incompatible beliefs are simultaneously true, and struggling to do so, the participants would apply the same scrutiny to their own beliefs. This intervention draws from (1) the illusion of explanatory depth (Rozenblit & Keil, 2002) and (2) construal-level theory research paradigm (Alter et al., 2010; Trope & Liberman, 2010). Within the illusion of explanatory depth paradigm, people usually first assess their knowledge of a concept, and then are asked to explicitly demonstrate that knowledge in detail (and realize they were overconfident in their assessments). Afterwards, their evaluation of their understanding of that concept becomes more accurate. Similarly, people could

realize the incompatibility of certain claims after considering how to reconcile them. In construal level terms, doublethink might arise due to a more abstract representation of beliefs, and having to explain their relation on a very concrete level might then lead to a more detailed consideration of one's own beliefs, thus forcing them to correct inconsistent ones.

Methods

Aims and hypotheses

To further probe if it is possible to reduce doublethink, we presented participants with pairs of incompatible claims (different from those in the Doublethink scale) and gave them an explicit task to reconcile them. We hypothesized that their inability to do so might push people to scrutinize their own beliefs for incompatibility, decreasing their further endorsement of contradictory beliefs in the Doublethink scale.

We expected that proneness to doublethink will decrease after the experimental manipulation in the experimental group relative to the control group (H1). We again preregistered the hypothesis and the design, alongside the analyses and the sampling plan - https://aspredicted.org/MDF_JXP.

Design and experimental manipulation

The study again followed a 2 (experimental manipulation: control vs experimental; between subjects) \times 2 (time point: pretest vs posttest; within-subjects) mixed design. The participants were randomly assigned to either the control or the experimental group, and all participants filled out the doublethink scale at two points - before and after the manipulation. The participants in the experimental group were presented with a total of five pairs of contradictory beliefs (e.g. *Everything happens for a reason* and *Life is just a series of random, purposeless events*), alongside two buffer non-contradictory pairs. Each pair was presented on a separate screen, with the question of whether or not those two beliefs can be simultaneously true. Depending on their answer, the participants were next asked either to elaborate why they both can be simultaneously true or why they cannot be. The participants were instructed to disregard their own beliefs, and just focus on the content of the claims. In the control group, the participants saw a total of seven beliefs, each again presented separately. Their task was to come up with two additional beliefs that are similar to the one presented.

Stimuli selection

To select the final set of contradictory pairs for the experimental manipulation, we ran a pilot study with $N = 120$ participants. We started with 10 pairs of contradictory beliefs (Supplement S4), and presented them to the participants alongside two buffer non-contradictory pairs. Alongside each pair, the participants were asked to write down how the two items could be simultaneously true. We subsequently recoded these answers as to indicate if the participants managed to reconcile the claims (coded as 0) or if they said that the items cannot be reconciled (coded as 1). Additionally, for each pair, we asked the participants to rate on a 7-point scale how (a) difficult; (b) tiresome and (c) irritating the task of explaining if the two items could be simultaneously true was. We then calculated for each pair (1) the number of participants who failed to reconcile the two claims and (2) the average rating across the three scales (i.e. how difficult, tiresome and irritating the task was). We finally chose five pairs that were most difficult to reconcile, i.e. those with highest scores on both criteria.

All the experimental materials for both the experimental and the control group can be found in Supplement S4: <https://osf.io/8phqz/>

Measures

Task evaluation. As in the stimuli selection part, we again asked the participants to evaluate the tasks on the three scales (difficult, tiresome and irritating) in both groups using a 7-point scale.

Doublethink was measured as in previous studies, with *B-RSES* as the buffer scale between two blocks, and we collected the same *sociodemographic* data.

Procedure

The survey was again hosted on the SoSci Survey platform (Leiner, 2023). The participants first provided their informed consent, and then proceeded with the doublethink pretest. They were then randomly allocated to either the control or the experimental condition, and went through the experimental manipulation, after which they filled out the task evaluation scales, and answered an open-ended question regarding their impressions of the task and their strategies in going through it. Finally, they filled the posttest doublethink scale, alongside the buffer scale, and provided sociodemographic data.

Sampling

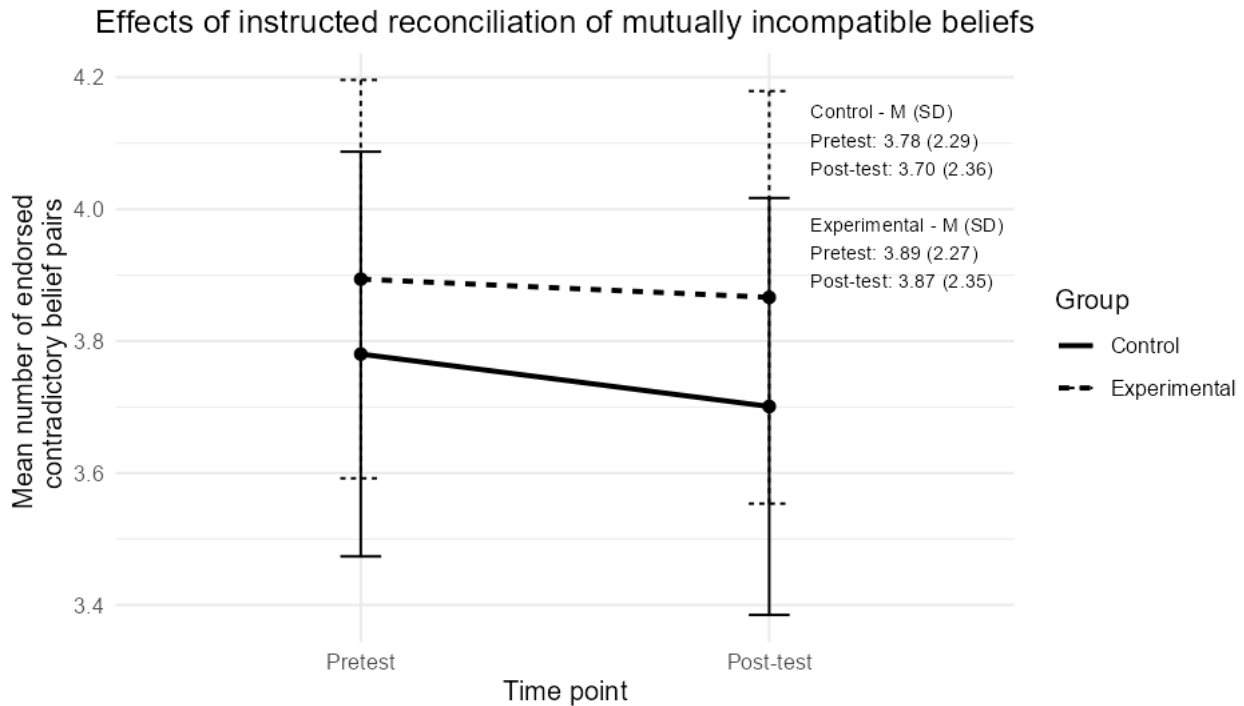
The needed sample size ($N = 434$ ($346 + 20\%$ to account for exclusions)) was based on an a priori power analysis with a small to medium effect size ($d = .35$) and power at .90 (see preregistration for details - https://aspredicted.org/MDF_JXP). A total of 434 Serbian participants completed the study in full. The participants were recruited using Facebook and Twitter ads. As per preregistration, we filtered out the participants that failed the attention checks ($n = 36$ for the first and $n = 2$ for the second attention checks), so they did not finish the study and did not count towards the final sample. In line with the preregistration, we then checked for differences in the total time spent on the questionnaire, and found significant differences between the control and the experimental group ($t(428.79) = -2.170, p = .031$; $M_{\text{control}} = 1206.671, M_{\text{exp}} = 1289.656$). Since we found significant differences, we calculated the RSI for each group separately, and then excluded participants who had an RSI above 2 in each group ($n = 2$ in the control group, and $n = 1$ in the experimental group). This means that the final sample was $N = 431$ ($n = 214$ in the control group and $n = 217$ in the experimental group). The sample consisted of 72.6% women, 26.7% men, while the rest of the participants chose the *other/rather would not say* option. The mean age of the participants was 46.62 ($SD = 12.73$).

Results

Figure 3 shows the mean doublethink scores across experimental groups and time points. We found no significant difference between the two groups on doublethink in the pretest ($t(428.78) = -0.517, p = .605$), while the correlation between doublethink scores in the pretest and the posttest was $r = .82$ ($p < .001$).

Figure 3

Doublethink score across experimental groups and time points with 95% confidence intervals - Study 2.2



We first checked whether the two groups differed in how they evaluated the task. We found significant differences on all three assessments but not in the expected direction - the task was perceived as more difficult ($t(428.97) = 2.163, p=.031; M_{\text{control}} = 3.38, M_{\text{exp}} = 3.02$), more tiresome ($t(428.57) = 2.882, p=.004; M_{\text{control}} = 3.50, M_{\text{exp}} = 2.98$) and more irritating ($t(413.56) = 3.316, p < .001; M_{\text{control}} = 2.74, M_{\text{exp}} = 2.18$) in the control group relative to the experimental group.

To test our main hypothesis, we ran a two-way mixed ANOVA, with experimental manipulation as the between-subjects factor and time point as the within-subjects factor. Contrary to our expectations (H1), there was no significant interaction between the two factors - $F(1, 429) = 0.145, p = .703$, i.e. the manipulation did not reduce doublethink. Moreover, we found no main effect of either the experimental manipulation ($F(1, 429) = 0.431, p = .512$) or of the time point ($F(1, 429) = 0.621, p = .431$).

As a robustness check, and in line with the preregistration, we also reran all the analyses after excluding outliers (using the same criteria as in Study 2.1; $n=19$) and those participants who managed to reconcile more than three pairs of contradictory beliefs ($n=87$). Results remained largely the same, with the exception of the time point factor being significant in these analyses (so that doublethink was slightly lower in the posttest overall), while there was still no effect of experimental manipulation or interaction. These analyses are available in Supplement S5: <https://osf.io/8phqz/>.

Finally, since neither of our two more subtle interventions had an effect, we devised an intervention with direct feedback on inconsistency.

Study 2.3 - Forced cross-referencing of own inconsistent beliefs

Drawing from the logic of metacognitive interventions, (e.g. Saenz et al., 2019), in which feedback on performance enhanced metacognitive skills (Flavell, 1979), i.e. helped people think about their cognitive processes, beliefs and skills better, we provided participants with feedback on

their own inconsistencies. It has been argued that one of the reasons why inconsistent beliefs are adopted is because only a limited number of beliefs are accessible at any given moment (Jovchelovitch & Priego-Hernández, 2015; Sommer et al., 2022) and that directly making beliefs accessible is one of the key ways to achieve consistency (Sommer et al., 2022). We thus expected that making both beliefs accessible simultaneously would prompt the participants to cross-reference the two beliefs and revise one.

Methods

Aims and hypotheses

We expected that doublethink would decrease in the experimental group, in which participants were faced with the fact they endorsed inconsistent beliefs, relative to the control group (i.e., that there would be an interaction between the experimental manipulation and time point). We again preregistered the hypothesis, the design, the analyses, as well as the sampling plan - https://aspredicted.org/BDD_CPC.

Design and experimental manipulation

We used the same experimental design as in the two previous studies. The participants were again randomly assigned either to the control or to the experimental group, and all participants filled out the doublethink scale both before and after the experimental manipulation.

In the experimental condition, after the pretest administration of the doublethink scale and the buffer scale, participants were shown one of the randomly selected contradictory pairs from the doublethink scale that they have previously agreed with. Alongside the items, they were shown a note that the items, in their stated form, are contradictory and cannot be true at the same time, that their agreement might indicate that their beliefs are inconsistent and that they should consider this before moving on with the questionnaire. Then they again filled out the doublethink scale and the buffer scale for the posttest, followed by the Dogmatism scale (see Materials section for details).

In the control condition, participants did not go through the experimental manipulation, and just filled out the Dogmatism scale between the pretest and the posttest doublethink assessment.

Materials

Dogmatism. As an additional buffer scale, the participants filled out the 20-item Dogmatism scale (e.g. “The things I believe in are so completely true, I could never doubt them.”; Altemeyer, 1996). The scale has 10 inversely coded items, and the participants indicated their agreement on a 9-point scale (1 - *completely disagree*; 9 - *completely agree*).

Doublethink was measured as in previous studies, with *B-RSES* as the buffer scale between two blocks, and we collected the same *sociodemographic* data, alongside socioeconomic status and highest level of education.

Procedure

The survey was hosted on the SoSci Survey platform (Leiner, 2023) as before. The participants first provided their informed consent, and then proceeded with the doublethink pretest, with the B-RSES presented to them between the two blocks of doublethink items. They were then randomly allocated to either the control or the experimental condition, and went through the experimental manipulation. The control group filled out the Dogmatism scale instead of the

experimental manipulation, followed by the posttest doublethink measure (with B-SRES as the buffer between two doublethink item blocks again), while the experimental group filled it after the posttest assessment of doublethink. Both groups filled out the sociodemographic questions at the end.

Sampling

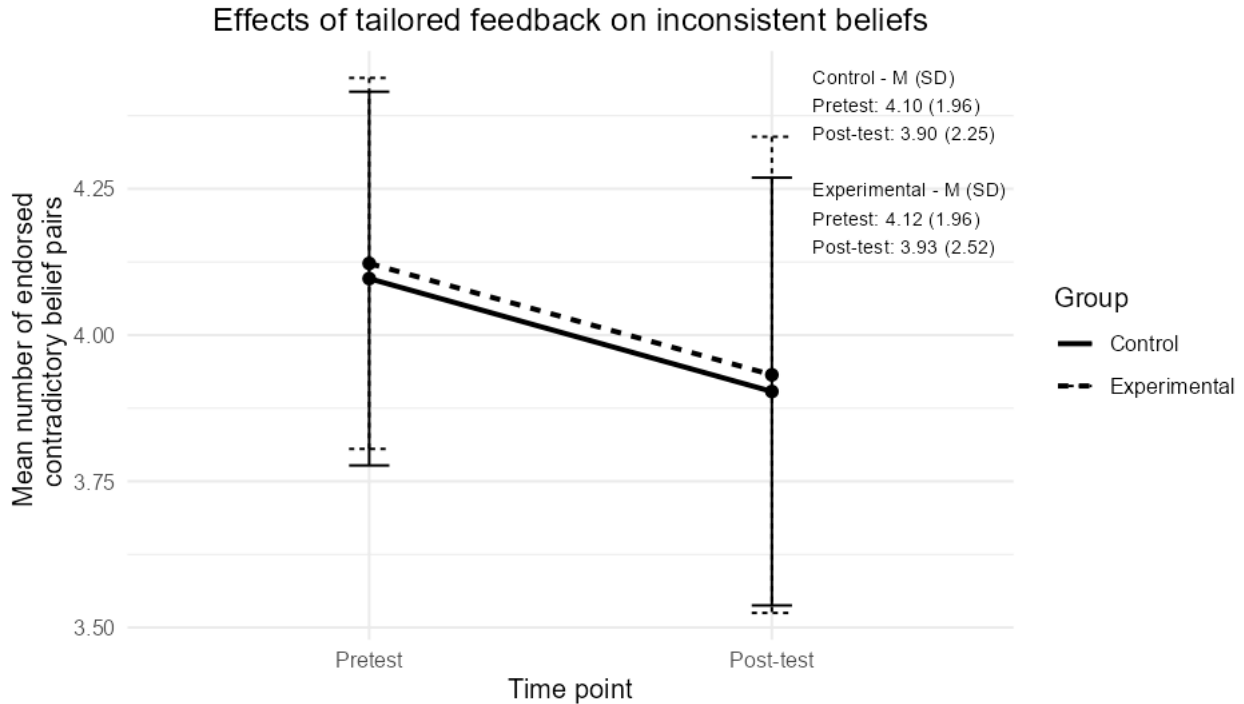
We again based our sample size on an a priori power analysis, with a small to medium effect size, and the power ranging from .80 to .90 (see preregistration for details - https://aspredicted.org/BDD_CPC). A total of 297 Serbian participants completed the study in full and passed both attention checks. The participants were recruited using Facebook and Twitter ads, so the sample size was again slightly larger than planned. As per preregistration, we automatically filtered out the participants who failed the attention checks ($n = 19$ for the first and $n = 7$ for the second attention checks). In line with the preregistration, we checked for differences in the total time spent on the questionnaire, and found no significant differences between the control and the experimental group ($t(289.88) = -1.259, p = .209$; $M_{\text{control}} = 813.745, M_{\text{exp}} = 856.170$). As there were no differences between the groups, we considered the sample as a whole, and excluded participants who had an RSI above 2 in the whole sample ($n = 5$). Our final sample was $N = 292$ ($n = 145$ in the control group and $n = 147$ in the experimental group). The sample consisted of 45.9% women, 52.4% men, while the rest of the participants chose the *other/rather would not say* option. The mean age of the participants was 47.98 (SD = 13.97).

Results

Following our analytical strategy from the previous two studies, we first examined the differences in doublethink across experimental groups and time points (Figure 4). We found no significant difference between the two groups on doublethink in the pretest ($t(289.94) = -0.113, p = .910$). The correlation between pretest and posttest doublethink scores was $r = .79$ ($p < .001$).

Figure 4

Doublethink score across experimental groups and time points with 95% confidence intervals - Study 2.3



Crucially, as a test of our hypothesis (H1), we ran a two-way mixed ANOVA, with experimental manipulation as the between-subjects factor and time point as the within-subjects factor. There was no significant interaction between the two factors - $F(1, 290) < .001, p = .988$, i.e. the manipulation did not reduce doublethink. Moreover, we found no main effect of the experimental manipulation ($F(1, 290) = 0.013, p = .910$), but there was a significant effect of time ($F(1, 290) = 4.918, p = .027, \text{partial } \eta^2 = .017$), with doublethink slightly decreasing between the two time points.

As a robustness check, and in line with the preregistration, we also reran all the analyses after excluding participants detected as univariate outliers whose mean score on doublethink was more than three times the median absolute deviation ($3 \times \text{MAD}$) away from the median score (Leys et al., 2013). We performed the outlier analysis on the scores within each group (i.e. control and experimental) and for the pretest and posttest scores separately. The results (available in Supplement S5) remained the same.

Evaluation of contradictions and strategies to reconcile them

All three interventions were based on the assumption that contradictions will be evaluated in the normative logic framework in which two inconsistent beliefs cannot be true at the same time. It is, however, also possible that participants simply did not evaluate inconsistency negatively and allowed their coexistence. Moreover, while those high on doublethink tend to agree with contradictory beliefs, we do not know how they reason about these beliefs. This is why, to better interpret the quantitative data, we decided to complement it with qualitative insights. In a series of semi-structured interviews we directly assessed whether people perceive their contradictory beliefs as such, how they evaluate these beliefs, whether they feel the need to explain their inconsistency and the need to correct them.

If people do not see the need to correct their beliefs despite inconsistency, they might adopt different strategies to reconcile them. Findings on inconsistent conspiratorial beliefs (Lukić et al.,

2019) suggest that, to deal with contradictions, people endorse a higher-order narrative that the official version of events is not true, making inconsistent conspiratorial explanations equally probable. Doublethink is however a more general propensity towards endorsement of contradictory beliefs of very diverse content. Thus, previously documented strategies might not always apply and novel ones might be observed.

Study 3 - Mapping spontaneous strategies for reconciliation of incompatible beliefs

Methods

Aims

In this study we conducted semi-structured interviews (similarly to Lukić et al., 2019) to explore (1) how people act when faced with their own inconsistencies and (2) which strategies they employ to reconcile their inconsistent beliefs.

Design and procedure

The participants took part in the study in two stages. In the first stage, they filled out the doublethink scale (Petrović & Žeželj, 2021), alongside the B-RSES scale (Monteiro et al., 2022), which was used as a buffer scale between the two blocks of doublethink items. Once they filled out the scale, the participants could apply to take part in the second stage of the study, which occurred approximately three weeks after the first. The second stage consisted of semi-structured interviews. The participants were first asked if they remembered some of the items from the questionnaire and asked if they noticed anything specific about the items. Then, the interviewer read out one of the contradictory pairs from the scale that the participant previously agreed with. After each item, the participants were asked if they recalled what they answered. Next, the interviewer read both of the items from the pair again, and asked the participant if they noticed something about the pair. If they pointed out the contradictory nature of the pair, they were asked to elaborate why they agreed with both of the items, and how they understood their relationship. If they did not highlight the contradictory nature of the pair on their own, the researcher pointed out that the items could be seen as contradictory and then asked the same questions. The interview guide is available in Supplement S6 on OSF: <https://osf.io/8phqz/>. The interviews were recorded and then transcribed verbatim for analysis, unless the participants declined to be recorded (n=3), in which case the researcher took detailed notes of the conversation. Fully anonymized interview transcripts/notes are available on OSF.

Participants

The participants were students of andragogy, pedagogy, and sociology (80% women, $M_{\text{age}} = 22.33$) who received course credits in exchange for participation. They were recruited from a larger pool of students who filled out the doublethink scale, based on whether or not they were interested in taking part in the interview. The participants were recruited until theoretical saturation was reached i.e. until no new strategies for contradiction reconciliation were elicited. This is a guiding principle of sampling in qualitative research, that entails sampling until no new information or themes emerge in the data i.e. until the findings start to repeat themselves (e.g. Guest et al., 2006; Mason, 2010). This way we ended up with a total of 15 semi-structured interviews which were all conducted by the same interviewer.

Analytic strategy and data coding

As the first step, the transcripts were analyzed to assess a. whether people acknowledged that the items they agreed with were contradictory, and b. whether they were likely to reassess their answers or they stood by their beliefs.

In the next step, we used qualitative content analysis (Elo & Kyngäs, 2008) to identify and categorize the strategies the participants employed to reconcile the contradictions. Qualitative content analysis is a method of analyzing qualitative data that relies on classifying similar units of analysis into thematic categories (Elo & Kyngäs, 2008). Our unit of analysis was the participant's answer to a question or a follow-up from the researcher. We relied on inductive coding to develop the categories. To come up with the coding scheme, we analyzed the data in several steps. Firstly, the first author openly coded the data and proceeded to group segments from the open coding into preliminary codes. The second author then went through the data and this preliminary coding scheme, and suggested further grouping or refining the codes. In the next step, both authors simultaneously went through the coding scheme and decided on its final form, which they then used to code the data again. Each segment was coded exclusively, with a single strategy code. The coding was conducted in MAXQDA version 24.3 (VERBI Software, 2021).

Results

Awareness of contradiction

On average, the participants endorsed three pairs of contradictory beliefs; there were no participants who did not endorse at least one pair. When prompted by the interviewer, in 17 instances the participants acknowledged that the pairs of statements they endorsed are in fact contradictory or can be seen as such; only in three instances they did not acknowledge that. This would suggest that participants were aware of contradictions. Even so the participants saw no problem in agreeing with both contradictory statements simultaneously (i.e. the participants, after they established that the statements are in fact contradictory, went on to explain why they endorsed both statements simultaneously - see transcripts on OSF for details). There was only a single participant that indicated that they would alter what they said previously due to the incompatibility of the statements (i.e. that they actually endorse only one of the statements in the pair). The participants articulated one or more strategies to explain why they accept the contradictory nature of the statements.

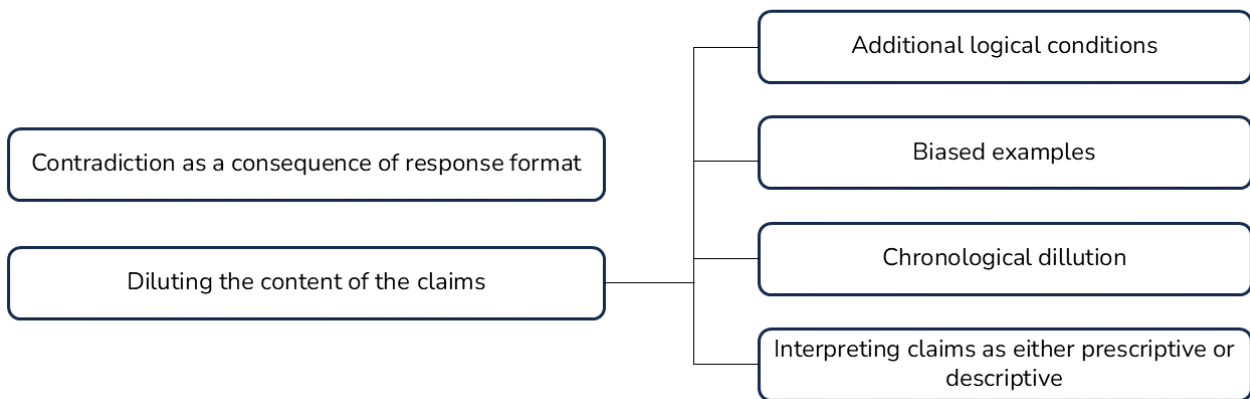
Strategies to reconcile incompatible beliefs

We identified two general strategies in the content analysis (Figure 5). One was to attribute the endorsement of contradiction to the response format (e.g. for the "Absolute honesty is necessary for a healthy relationship." item - "*If I indicate a three on the scale, that means that some irrelevant information can be kept from the partner, but not major things that are crucial for the relationship*" or for the item "You can never drink too much water" - "*This depends on the extent of agreement, we, of course, need a lot of water, but still not too much*"). They focused specifically on the fact that they had to give their answer on a scale and what meaning they attributed to the degree of agreement with an item.

The second strategy relied on diluting/relativizing the explicit content of the items in certain ways to allow for contradictions to coexist. Within this category, we observed four different sub-strategies: (1) introducing additional logical conditions, (2) using biased examples, (3) diluting the content chronologically and (4) interpreting statements as either prescriptive or descriptive.

Figure 5

Strategies employed to explain contradictions



Regarding (1), participants imbued the items with additional conditions that were not a part of the item's explicit content (e.g. for the item pair "Some people are essentially irreparable" and "Every single person is capable of growth and change" the participants said that "...*even though people have the capacity for change, some do not want to change, which makes them practically irreparable*"). Participants did not consider the items at face value, but rather gave them a more complex meaning, which then allowed them to overcome the explicit contradiction in the items.

Similarly, for (2) the participants came up with examples where one claim in the pair holds true, and then other examples where the other holds true (e.g. for the item pair "No matter how hard they try, people cannot escape their genetics" and "Regardless of their genetic predispositions, people forge their own destinies" a participant said "*I probably meant some segments and not generally. For example some things like race... or something like that, that cannot be changed, but if someone has a low socioeconomic status, they can overcome that*"). While the items were formulated as general beliefs, this strategy suggests that participants do not consider them as such, but find examples that confirm both contradictory statements separately.

As for (3) chronological dilution, participants interpreted the claims to be true at different points in time. For example, for the pair (a) A man is a wolf to his fellow men and (b) People always lean and rely on each other, one participant said "*...a man is a wolf to his fellow men when they first meet, but afterwards we rely on each other*".

Finally, participants assigned the items in a pair (4) either a prescriptive or a descriptive status. This entailed describing one belief as descriptive of how the world is, and the other of how it should be, thus overcoming the contradiction (e.g. for the pair "Voting should be mandatory for everyone" and "Some people should clearly not be allowed to vote." one participant indicated that "*since it's*

not mandatory, some need to be prohibited to vote, but if it were mandatory, there would be no need to prohibit certain people to vote”).

Frequency of employed strategies

A single participant did not rely on one strategy exclusively, but often used different strategies for different or even the same pair of contradictory items (Figure 6). In general, the most frequently used strategies were the use of additional logical conditions (coded in 13 instances across all interviews) and the explanation of contradictions through response style (coded in 11 instances across all interviews). Conversely, the chronological dilution strategies and the prescriptive/descriptive strategy were the least frequent (each coded in 2 instances across all interviews).

Figure 6

Heatmap of frequency of coded strategies per interviews

	I15	I14	I13	I12	I11	I10	I9	I8	I7	I6	I5	I4	I3	I2	I1	SUM
dilution of content																
prescriptive vs descriptive	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
chronological dilution	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2
biased examples	1	1	1	0	0	1	0	0	0	1	3	2	0	0	0	10
additional logical conditions	1	1	0	4	0	1	0	2	1	1	0	1	0	1	0	13
response style	0	1	0	0	2	1	0	1	0	0	1	0	2	0	3	11
SUM	3	3	1	4	2	3	0	3	3	2	4	3	3	1	3	38

Discussion

Our results indicate that those who are prone to contradictory beliefs are both less successful in spotting contradictions, and more prone to a superficial information processing style (reflected in more intuitive thinking and less success in syllogistic reasoning). While we did find zero-order correlations with the executive function of updating, when thinking style and the contradiction spotting ability were taken into account, updating no longer contributed to the prediction of doublethink. While the relations of doublethink to contradiction spotting ability and superficial processing were replicated in a follow-up study, this time we found no zero-order correlations to the executive function of shifting. This suggests that doublethink is a tendency that is not dominantly a reflection of a general cognitive deficit, but rather of a less sensitivity to contradictions and a tendency to rely on gut feelings in reasoning.

For those higher on doublethink, the belief system seems to be more permissive upon entry since contradictions are not spotted, allowing beliefs to be indiscriminately adopted. However, within the belief system, the beliefs are compartmentalized and rarely cross-referenced against each other and subsequently, rarely updated, indicating a more rigid belief structure (Petrović & Žeželj, 2024). This is in line with previous findings where the strongest (negative) thinking style correlate of doublethink is actively open-minded thinking i.e. readiness to revise beliefs according to new information (Petrović & Žeželj, 2023; 2024).

Correcting contradictory beliefs seems to be a hard task - none of the experimental manipulations we tested, which were of different levels of subtlety, yielded any effects on doublethink. Our last study potentially gives a clue as to why - all three of our interventions hinged on the participants noticing contradictions, finding them problematic and consequently revising their beliefs. However, it seems that people do not evaluate the simultaneous endorsement of contradictions negatively. In alternative logic systems, such as paraconsistent logic, contradictions

are not automatically dismissed and are sometimes even considered to be informative (Priest et al., 2022). Similarly, the authors exploring *cognitive polyphasia* also see cognition as inseparable from contradictions (Jovchelovitch, 2008) and inconsistencies a useful part of our social representations instead of something needing correction (Jovchelovitch & Priego-Hernández, 2015).

Our findings are in line with the proposition that an important final step in reasoning from inconsistent premises is to resolve the inconsistency by providing explanations of it (Johnson-Laird et al., 2004). Not only that, but these explanations of inconsistencies also make individuals less likely to detect inconsistencies (Khemlani & Johnson-Laird, 2014). This is why our participants, when faced with their inconsistent beliefs, instead of correcting contradictions, assume strategies that allow them to bypass them in meaningful ways. This type of post-hoc rationalization of inconsistency might serve as an adaptive process (Cushman, 2020) that can give insights for future belief revision, especially given that complete consistency within the belief system seems highly unlikely (Sommer et al., 2022).

The most common strategy our participants resorted to is the generation of additional logical conditions that are not an explicit part of the considered belief. In line with a Bayesian framework, in order to preserve both contradictory beliefs, and overcome the inconsistency, participants generate auxiliary hypotheses (i.e. additions or modifications of the considered beliefs) that then serve as safeguards for those beliefs (Gershman, 2019) - this is considered a rational belief-updating mechanism.

While we do not put any value judgment on endorsement of contradictory beliefs, this ease in circumventing contradictions can potentially lead to problematic consequences, such as acceptance of different standards being applied for different groups or posing irreconcilable expectations to minority groups (e.g., *Migrants are taking our jobs*, and simultaneously *are lazy and leeching off of our social aid*; or *Jews are over assimilative* and simultaneously *are refusing to assimilate*, as in Levinson & Sanford, 1944). Such a highly compartmentalized mind has already been deemed typical for an authoritarian personality (Altemeyer, 2008). This highlights the importance of submitting doublethink to more empirical scrutiny in future research.

Limitations and future research

Different experimental manipulations did not reduce doublethink, probably due to the lack of negative evaluation of endorsement of contradiction. Future interventions could focus on attaching negative evaluations to it - for example, through highlighting the consequences of moral relativization or double standards that could arise from doublethink. Additionally, as syllogistic reasoning was the dominant correlate of doublethink in Study 1, interventions that tackle superficial information processing (e.g. debiasing interventions (Isler & Yilmaz, 2023) or interventions directly correcting errors in syllogistic reasoning) could be an avenue for future research.

Given the design of our studies, we focused on contradictory beliefs that have already been formed. Future studies could apply a more process-oriented perspective, by exploring how contradictory beliefs are formed and maintained via longitudinal designs.

In our last study, we faced people with their contradictory beliefs and asked them to elaborate on how those two beliefs could be simultaneously true. The strategies they used to reconcile inconsistencies, might not occur spontaneously. Future studies could thus ask people to elaborate on their beliefs right after they answer how much they endorse them. Afterwards, their explanations for contradictory claims can be examined to evaluate whether the same strategies for reconciliation of beliefs are used without prompt. Future research could also draw from the fact that one strategy for resolving contradictions that emerged was attributing inconsistency to the response format. It is true

that we use a 4-point scale and then classify people as either agreeing or disagreeing with a claim even though they might only partially agree with it. They, however, still have an option to be consistent in their partial agreements. Even if we consider this a flaw in the measure, the measure still repeatedly shows robust, meaningful relations to a range of convergent constructs. Researchers could nevertheless consider using a binary format, albeit its potential problem with lower dispersion. We find that mixed method studies like ours are useful precisely for complementing quantitative ones, e.g. by demonstrating how participants perceive giving answers on standard psychological scales.

Finally, researchers could also directly explore the hypothesized negative outcomes related to doublethink in the intergroup domain, including whether endorsement of contradictory beliefs is related to having inconsistent standards for different groups or irreconcilable expectations from, for example, minority groups.

Conclusions

The results of five preregistered studies and a set of in-depth interviews suggest that inconsistency within belief systems is neither as uncommon nor as undesirable as it is often assumed. We found that people rarely correct contradictory beliefs, even when prompted to cross-reference them. Instead, they employ various strategies to maintain these conflicting views. Potential negative outcomes of doublethink (e.g. double standards), however, highlight the need for alternative strategies to mitigate it.

Chapter 4 References

- Altemeyer, B. (1996). *The authoritarian specter*. Harvard University Press.
- Altemeyer, B. (2008). *The authoritarians*. Cherry Hill Publishing.
- Alter, A. L., Oppenheimer, D. M., & Zemla, J. C. (2010). Missing the trees for the forest: A construal level account of the illusion of explanatory depth. *Journal of Personality and Social Psychology*, 99(3), 436–451. <https://doi.org/10.1037/a0020218>
- Biddlestone, Mikey, Cichocka, Aleksandra, Žeželj, I., & Bilewicz, Michał. (2020). Conspiracy theories and intergroup relations. In Michael Butter & P. Knight (Eds.), *Routledge handbook of conspiracy theories*. Routledge.
- Cushman, F. (2020). Rationalization is rational. *Behavioral and Brain Sciences*, 43, e28. <https://doi.org/10.1017/S0140525X19001730>
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64, 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Draheim, C., Hicks, K. L., & Engle, R. W. (2016). Combining reaction time and accuracy: The relationship between working memory capacity and task switching as a case example. *Perspectives on Psychological Science*, 11(1), 133–155. <https://doi.org/10.1177/1745691615596990>
- Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), 107–115. <https://doi.org/10.1111/j.1365-2648.2007.04569.x>
- Festinger, L. (1957). *A theory of cognitive dissonance*. (pp. xi, 291). Stanford University Press.
- Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. *American Psychologist*, 34(10), 906–911. <https://doi.org/10.1037/0003-066X.34.10.906>
- Fonseca, R., Blascovich, J., & Garcia-Marques, T. (2014). Challenge and threat motivation: Effects on superficial and elaborative information processing. *Frontiers in Psychology*, 5. <https://doi.org/10.3389/fpsyg.2014.01170>
- Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, 86, 186–204. <https://doi.org/10.1016/j.cortex.2016.04.023>
- Friedman, N. P., Miyake, A., Young, S. E., DeFries, J. C., Corley, R. P., & Hewitt, J. K. (2008). Individual differences in executive functions are almost entirely genetic in origin. *Journal of Experimental Psychology: General*, 137(2), 201–225. <https://doi.org/10.1037/0096-3445.137.2.201>
- Galinsky, A. D., Moskowitz, G. B., & Skurnik, I. (2000). Counterfactuals as self-generated primes: The effect of prior counterfactual activation on person perception judgments. *Social Cognition*, 18(3), 252–280. <https://doi.org/10.1521/soco.2000.18.3.252>

- Gershman, S. J. (2019). How to never be wrong. *Psychonomic Bulletin & Review*, 26(1), 13–28. <https://doi.org/10.3758/s13423-018-1488-8>
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough?: An experiment with data saturation and variability. *Field Methods*, 18(1), 59–82. <https://doi.org/10.1177/1525822X05279903>
- Heider, F. (1946). Attitudes and Cognitive Organization. *The Journal of Psychology*, 21(1), 107–112. <https://doi.org/10.1080/00223980.1946.9917275>
- Hirt, E. R., Kardes, F. R., & Markman, K. D. (2004). Activating a mental simulation mind-set through generation of alternatives: Implications for debiasing in related and unrelated domains. *Journal of Experimental Social Psychology*, 40(3), 374–383. <https://doi.org/10.1016/j.jesp.2003.07.009>
- Hughes, M. M., Linck, J. A., Bowles, A. R., Koeth, J. T., & Bunting, M. F. (2014). Alternatives to switch-cost scoring in the task-switching paradigm: Their reliability and increased validity. *Behavior Research Methods*, 46(3), 702–721. <https://doi.org/10.3758/s13428-013-0411-5>
- Imhoff, R., Dieterle, L., & Lamberty, P. (2021). Resolving the Puzzle of Conspiracy Worldview and Political Activism: Belief in Secret Plots Decreases Normative but Increases Nonnormative Political Engagement. *Social Psychological and Personality Science*, 12(1), 71–79. <https://doi.org/10.1177/1948550619896491>
- Isler, O., & Yilmaz, O. (2023). How to activate intuitive and reflective thinking in behavior research? A comprehensive examination of experimental techniques. *Behavior Research Methods*, 55(7), 3679–3698. <https://doi.org/10.3758/s13428-022-01984-4>
- Johnson-Laird, P. N., Girotto, V., & Legrenzi, P. (2004). Reasoning From Inconsistency to Consistency. *Psychological Review*, 111(3), 640–661. <https://doi.org/10.1037/0033-295X.111.3.640>
- Jokić, B., Purić, D., & Knežević, G. (2022). REI-8: Development of a very brief version of rational-experiential inventory using ant colony optimization procedure. *Book of Abstracts*, 62–63.
- Jovchelovitch, S. (2008). The Rehabilitation of Common Sense: Social Representations, Science and Cognitive Polyphasia. *Journal for the Theory of Social Behaviour*, 38(4), 431–448. <https://doi.org/10.1111/j.1468-5914.2008.00378.x>
- Jovchelovitch, S., & Priego-Hernández, J. (2015). Cognitive polyphasia, knowledge encounters and public spheres. In G. Sammut, E. Andreouli, G. Gaskell, & J. Valsiner (Eds.), *The Cambridge Handbook of Social Representations* (pp. 163–178). Cambridge University Press. <https://doi.org/10.1017/CBO9781107323650.014>
- Khemlani, S. S., & Johnson-Laird, P. N. (2012). Hidden conflicts: Explanations make inconsistencies harder to detect. *Acta Psychologica*, 139(3), 486–491. <https://doi.org/10.1016/j.actpsy.2012.01.010>
- Knežević, G., Petrović, M., Ninković, M., Zupan, Z., Purić, D., Lukić, P., Živanović, M., Teovanović, P., Stanković, S., & Žeželj, I. (2024). *Lifetime prevalence of questionable health behaviors and their psychological roots: A preregistered nationally representative survey*. <https://doi.org/10.31234/osf.io/zf4q7>

- Lazarević, L. B., Knežević, G., Purić, D., Teovanović, P., Petrović, M. B., Ninković, M., Živanović, M., Stanković, S., Branković, M., Lukić, P., Opačić, G., & Žeželj, I. (2023). Tracking variations in daily questionable health behaviors and their psychological roots: A preregistered experience sampling study. *Scientific Reports*, *13*(1), 14058. <https://doi.org/10.1038/s41598-023-41243-w>
- Leiner, D. J. (2019). Too Fast, too Straight, too Weird: Non-Reactive Indicators for Meaningless Data in Internet Surveys. *Survey Research Methods*, *13*(3), Article 3. <https://doi.org/10.18148/srm/2019.v13i3.7403>
- Leiner, D. J. (2023). *SoSci Survey* (Version 3.4.22) [Computer software]. <https://www.soscisurvey.de>
- Levinson, D. J., & Sanford, R. N. (1944). A Scale for the Measurement of Anti-Semitism. *The Journal of Psychology*, *17*(2), 339–370. <https://doi.org/10.1080/00223980.1944.9917200>
- Leys, C., Klein, O., Dominicy, Y., & Ley, C. (2018). Detecting multivariate outliers: Use a robust variant of the Mahalanobis distance. *Journal of Experimental Social Psychology*, *74*, 150–156. <https://doi.org/10.1016/j.jesp.2017.09.011>
- Lukić, P., Žeželj, I., & Stanković, B. (2019). How (ir)rational is it to believe in contradictory conspiracy theories? *Europe's Journal of Psychology*, *15*(1), 94–107. <https://doi.org/10.5964/ejop.v15i1.1690>
- Mason, M. (2010). Sample Size and Saturation in PhD Studies Using Qualitative Interviews. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *11*(3), Article 3. <https://doi.org/10.17169/fqs-11.3.1428>
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The Unity and Diversity of Executive Functions and Their Contributions to Complex “Frontal Lobe” Tasks: A Latent Variable Analysis. *Cognitive Psychology*, *41*(1), 49–100. <https://doi.org/10.1006/cogp.1999.0734>
- Monteiro, R. P., Coelho, G. L. D. H., Hanel, P. H. P., De Medeiros, E. D., & Da Silva, P. D. G. (2022). The Efficient Assessment of Self-Esteem: Proposing the Brief Rosenberg Self-Esteem Scale. *Applied Research in Quality of Life*, *17*(2), 931–947. <https://doi.org/10.1007/s11482-021-09936-4>
- Petrović, M. B., & Žeželj, I. (2021). Thinking Inconsistently: Development and Validation of an Instrument for Assessing Proneness to Doublethink. *European Journal of Psychological Assessment*, *1015-5759/a000645*. <https://doi.org/10.1027/1015-5759/a000645>
- Petrović, M. B., & Žeželj, I. (2024). Exploring the Mechanisms that Allow Incompatible Beliefs to Coexist in the Cognitive System. *Psychological Reports*, *00332941241280870*. <https://doi.org/10.1177/00332941241280870>
- Petrović, M., & Žeželj, I. (2023). Both a bioweapon and a hoax: The curious case of contradictory conspiracy theories about COVID-19. *Thinking & Reasoning*, *29*(4), 456–487. <https://doi.org/10.1080/13546783.2022.2088618>
- Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, *76*(6), 972–987. <https://doi.org/10.1037/0022-3514.76.6.972>

- Pfeifer, N., & Kleiter, G. D. (2005). Coherence and Nonmonotonicity in Human Reasoning. *Synthese*, 146(1), 93–109. <https://doi.org/10.1007/s11229-005-9073-x>
- Purić, D. B. (2014). *Odnos egzekutivnih funkcija i crta ličnosti* [University of Belgrade, Faculty of Philosophy]. <https://nardus.mpn.gov.rs/handle/123456789/3328>
- Priest, G., Tanaka, K., & Weber, Z. (2018). Paraconsistent Logic. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Summer 2018). Metaphysics Research Lab, Stanford University. <https://plato.stanford.edu/archives/sum2018/entries/logic-paraconsistent/>
- R Core Team (2021). R: A language and environment for statistical computing [Computer software]. <https://www.R-project.org/>
- Rose, J. M., Ganbold, O., Rose, A. M., Thibodeau, J. C., & Rotaru, K. (2024). Overcoming resistance to belief revision and correction of misinformation beliefs: Psychophysiological and behavioral effects of a counterfactual mindset. *Scientific Reports*, 14(1), 12493. <https://doi.org/10.1038/s41598-024-63230-5>
- Rozenblit, L., & Keil, F. (2002). The misunderstood limits of folk science: An illusion of explanatory depth. *Cognitive Science*, 26(5), 521–562. https://doi.org/10.1207/s15516709cog2605_1
- Saenz, G. D., Geraci, L., & Tirso, R. (2019). Improving metacognition: A comparison of interventions. *Applied Cognitive Psychology*, 33(5), 918–929. <https://doi.org/10.1002/acp.3556>
- Schwind, N., Konieczny, S., & Pérez, R. P. (2022). On Paraconsistent Belief Revision in LP. *Proceedings of the AAAI Conference on Artificial Intelligence*, 36(5), Article 5. <https://doi.org/10.1609/aaai.v36i5.20532>
- Simon, D., & Holyoak, K. J. (2002). Structural Dynamics of Cognition: From Consistency Theories to Constraint Satisfaction. *Personality and Social Psychology Review*, 6(4), 283–294. https://doi.org/10.1207/S15327957PSPR0604_03
- Sommer, J., Musolino, J., & Hemmer, P. (2023). A hobgoblin of large minds: Troubles with consistency in belief. *WIREs Cognitive Science*, 14(4), e1639. <https://doi.org/10.1002/wcs.1639>
- Tam, K.-P., & Chan, H.-W. (2023). Conspiracy theories and climate change: A systematic review. *Journal of Environmental Psychology*, 91, 102129. <https://doi.org/10.1016/j.jenvp.2023.102129>
- Taschner, N. P., Orsi, C., Almeida, P., & Pilati, R. (2022). The impact of personal pseudoscientific beliefs in the pursuit for non-evidence-based health care. *Journal of Evidence-Based Healthcare*, 3, e3516. <https://doi.org/10.17267/2675-021Xevidence.2021.e3516>
- Teovanović, P., Knežević, G., & Stankov, L. (2015). Individual differences in cognitive biases: Evidence against one-factor theory of rationality. *Intelligence*, 50, 75–86. <https://doi.org/10.1016/j.intell.2015.02.008>
- Thagard, P. (2007). Coherence, truth, and the development of scientific knowledge. *Philosophy of Science*, 74(1), 28–47. <https://doi.org/10.1086/520941>

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review*, 117(2), 440–463. <https://doi.org/10.1037/a0018963>

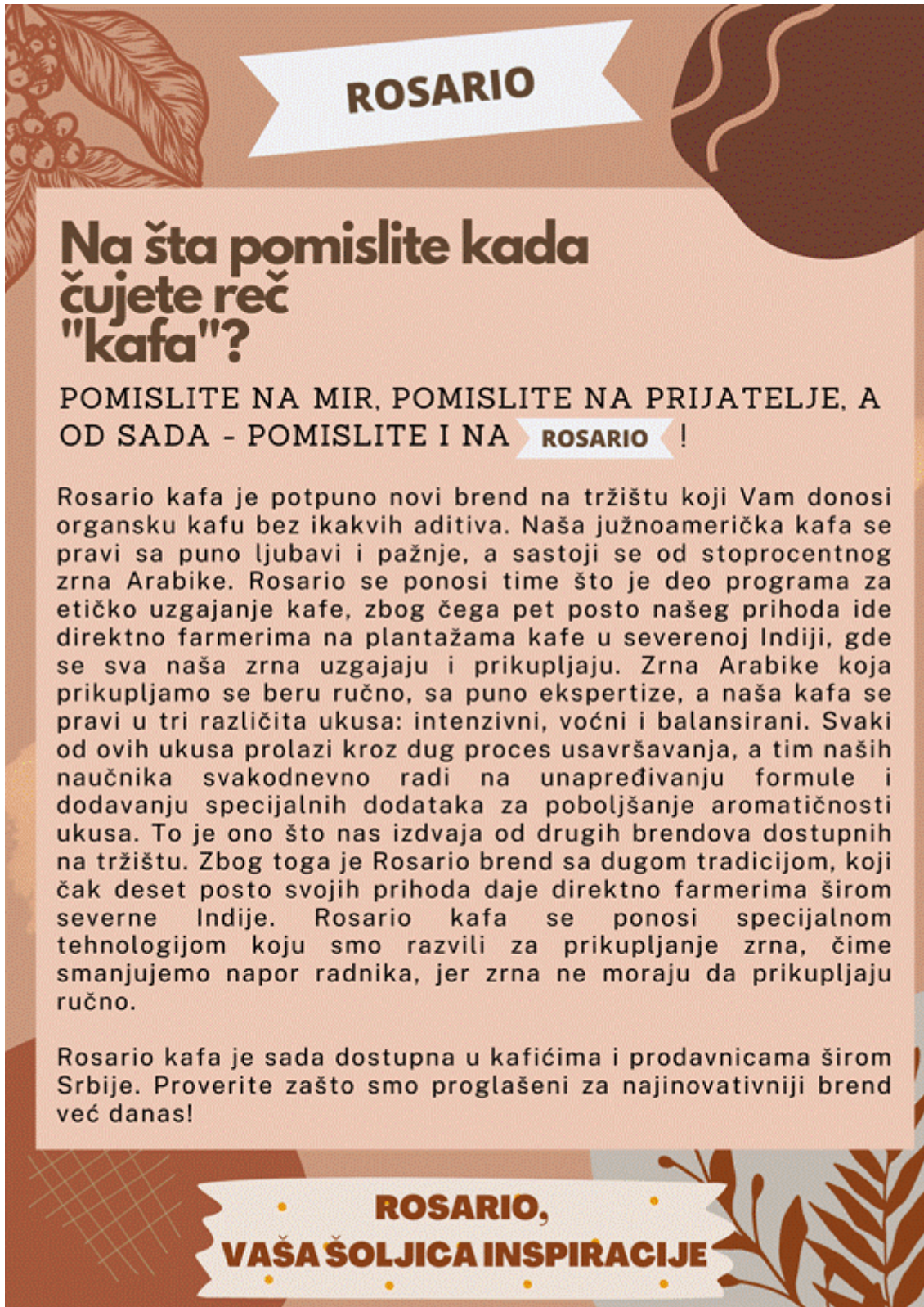
VERBI Software. (2021). *MAXQDA 2022* [Computer software]. maxqda.com

Wilhelm, O., Hildebrandt, A. H., & Oberauer, K. (2013). What is working memory capacity, and how can we measure it? *Frontiers in Psychology*, 4. <https://doi.org/10.3389/fpsyg.2013.00433>

Chapter 4 - Supplementary information

Supplement S1

Ad (in original formatting, in Serbian)



ROSARIO

Na šta pomislite kada čujete reč "kafa"?

POMISLITE NA MIR, POMISLITE NA PRIJATELJE, A OD SADA - POMISLITE I NA **ROSARIO !**

Rosario kafa je potpuno novi brend na tržištu koji Vam donosi organsku kafu bez ikakvih aditiva. Naša južnoamerička kafa se pravi sa puno ljubavi i pažnje, a sastoji se od stoprocentnog zrna Arabike. Rosario se ponosi time što je deo programa za etičko uzgajanje kafe, zbog čega pet posto našeg prihoda ide direktno farmerima na plantažama kafe u severnoj Indiji, gde se sva naša zrna uzgajaju i prikupljaju. Zrna Arabike koja prikupljamo se beru ručno, sa puno ekspertize, a naša kafa se pravi u tri različita ukusa: intenzivni, voćni i balansirani. Svaki od ovih ukusa prolazi kroz dug proces usavršavanja, a tim naših naučnika svakodnevno radi na unapređivanju formule i dodavanju specijalnih dodataka za poboljšanje aromatičnosti ukusa. To je ono što nas izdvaja od drugih brendova dostupnih na tržištu. Zbog toga je Rosario brend sa dugom tradicijom, koji čak deset posto svojih prihoda daje direktno farmerima širom severne Indije. Rosario kafa se ponosi specijalnom tehnologijom koju smo razvili za prikupljanje zrna, čime smanjujemo napor radnika, jer zrna ne moraju da prikupljaju ručno.

Rosario kafa je sada dostupna u kafićima i prodavnicama širom Srbije. Proverite zašto smo proglašeni za najinovativniji brend već danas!

**ROSARIO,
VAŠA ŠOLJICA INSPIRACIJE**

Translation (English)

Rosario

What do you think about when you hear the word “coffee”? You think about peace, you think about friends, and from now on you will also think - Rosario!

Rosario coffee is a completely new brand on the market that brings you organic coffee without any additives. Our South American coffee is made with a lot of love and attention, and its made from 100% Arabica beans. Rosario is proud to be a part of the ethical cultivation of coffee programme, which is why five percent of our income goes directly to the farmers on Indian coffee plantations, where all our coffee beans are cultivated and sourced from. The Arabica beans we use are gathered by hand, with a lot of expertise, and our coffee comes in three flavor profiles: intense, fruity and balanced. Each of these flavors goes through a long perfecting process, and a team of our scientists works daily on improving the formula and adding special ingredients to increase the flavourness of our coffee. This is what sets us apart from other brands available on the market. This is why Rosario is a brand with a longstanding tradition, that donates even ten percent of its income directly to farmers all across northern India. Rosario coffee prides itself on the special technology of gathering coffee beans that we developed, making it possible for coffee beans not to be gathered by hand.

Rosario coffee is now available in coffee shops and supermarkets across Serbia. See for yourself why we were named the most innovative brand on the market today!

Rosario, your cup of inspiration!

Note. Contradiction pairs are labeled with the same color.

Supplement S2

To account for skewed data, we normalized variables (using rank-based Rankit transformation; Solomon & Sawilovsky, 2009) that had an absolute value of Sk and Ku over .50 and then reran our analyses with the new variables. All of the variables were normalised.

Table S2.1

Correlations between variables after normalization

Variable	1	2	3	4	5	
1. Doublethink (0-11)	0.66					
2. N-back/updating (0-1)	-.16*	/				
3. Sensitivity to contradiction (0-5)	-.21**	.14*	/			
4. Rational thinking style (1-5)	-0.02	-0.02	0.11	0.72		
5. Experiential thinking style (1-5)	.16*	-0.07	-0.11	-0.03	0.79	
6. Syllogistic reasoning (0-4)	-.35***	.30***	.19**	.14*	-.20**	0.71

Note. The diagonal shows reliabilities (alpha for all except doublethink, where GLB is shown (see Petrović & Žeželj, 2022 for details))

Table S2.2*Regression results using doublethink as the criterion with normalized variables*

Predictor	b	beta	Beta 95% CI [LL, UL]	Fit	Difference
<i>Step 1</i>					
Sensitivity to inconsistency	-0.15**	-0.19	[-0.31, -0.06]	$R^2 = .060^{**}$	
N-back/updating	-0.13*	-0.13	[-0.26, -0.01]		
<i>Step 2</i>					
Sensitivity to inconsistency	-0.11*	-0.14	[-0.26, -0.01]	$R^2 = .152^{**}$ $\Delta R^2 = .093^{**}$	
N-back/updating	-0.05	-0.05	[-0.17, 0.08]		
Rational thinking style	0.04	0.04	[-0.08, 0.16]		
Experiential thinking style	0.08	0.08	[-0.04, 0.20]		
Syllogistic reasoning	-0.34***	-0.3	[-0.43, -0.17]		

Note. A significant b-weight indicates the beta-weight is also significant. b represents unstandardized regression weights. beta indicates the standardized regression weights. LL and UL indicate the lower and upper limits of a confidence interval, respectively.

* indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$

Supplement S3

To account for skewed data, we normalized variables (using rank-based Rankit transformation; Solomon & Sawilovsky, 2009) that had an absolute value of Sk and Ku over .50 (shifting, sensitivity to contradiction and syllogistic reasoning) and then reran our analyses with the new variables.

Table S3.1

Correlations between variables after normalization

Variable	1	2	3	4	5	
1. Doublethink (0-11)	0.76					
2. Shifting	-0.02	0.65				
3. Sensitivity to contradiction (0-5)	-.21***	-.16**	/			
4. Rational thinking style (1-5)	0.02	-0.01	0.07	0.75		
5. Experiential thinking style (1-5)	.15**	0	-0.07	0.08	0.76	
6. Syllogistic reasoning (0-4)	-.43***	-.13*	.29***	.22***	-.13*	0.72

Note. The diagonal shows reliabilities (alpha for all except doublethink, where GLB is shown (see Petrović & Žeželj, 2022 for details))

Table S2.2*Regression results using doublethink as the criterion with normalized variables*

Predictor	<i>b</i>	<i>beta</i>	<i>beta</i> 95% CI [LL, UL]	Fit	Difference
<i>Step 1</i>					
Sensitivity to inconsistency	-0.55***	-0.22	[-0.33, -0.11]	$R^2 = .040^{**}$	
Shifting	-0.13	-0.06	[-0.17, 0.05]		
<i>Step 2</i>					
Sensitivity to inconsistency	-0.26	-0.1	[-0.20, 0.00]	$R^2 = .212^{**}$	$\Delta R^2 = .172^{**}$
Shifting	-0.22	-0.09	[-0.19, 0.01]		
Rational thinking style	0.37*	0.12	[0.02, 0.22]		
Experiential thinking style	0.2	0.08	[-0.02, 0.18]		
Syllogistic reasoning	-1.20***	-0.43	[-0.54, -0.33]		

Note. A significant *b*-weight indicates the beta-weight is also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.

* indicates $p < .05$, ** indicates $p < .01$, *** indicates $p < .001$

Supplement S4

Study 2.1

Control group

Original (Serbian)

Kljunar ili čudnovati kljunar kako ga nekad zovu je mali, stidljivi sisar iz predela Australije i Tasmanije. Kljunari su slatkovodne životinje, koje žive u rukavcima reka obraslih drvećem. Dlaka mu je tamnosmeđa po leđima, dok je na trbuhu svetlija. Na glavi s kratkim i neistaknutim vratom ima širok, pljosnat, mekan i savitljiv kljun poput patke, kojim hvata sićušne električne titraje koje odašilje njihov plen. Uši su mu bez ušnih školjki i može da ih zatvori. Kljunari imaju mesnati jezik pokriven rožnatim zubićima, koji potpuno ispunjava njihovu usnu šupljinu. I mužjaci i ženke kljunara su rođeni sa rožnatim ostrugama na šapama, ali samo mužjaci imaju otrov u njima. Njegova funkcija je da uništi bakterije i viruse, ali kljunari mnogo više koriste svoj otrov za odbranu. Dok roni, kljunar drži zatvorene oči, uši i nozdre, a oslanja se jedino na svoj vrlo osetljiv kljun, pomoću kojeg nalazi hranu. Hranu traži u mulju dok roni, a hrani se malim vodenim životinjama, kao što su puževi, školjke, slatkovodni rakovi i larve crva. Hranu koju ulovi, skladišti u malim kesama koje se nalaze iza kljuna i jede tek kada se vrati na površinu. Višak hranljivih materija čuva u repu u obliku masti.

Translation (English)

Platypus or the wondrous platypus as it is sometimes referred to is a small, shy mammal from the regions of Australia and Tasmania. The platypuses are freshwater animals that live in river distributaries that are covered with trees. Its hair is dark brown on its back, and lighter on its belly. On its head with a short and unpointed neck, the platypus has a wide, flat, soft and flexible duck-like beak, used for catching tiny electrical vibrations that are sent by its prey. Its ears have no auricles and they can be closed. Platypuses have a meaty tongue covered in horny teeth that completely cover its oral cavity. Both male and female platypuses are born with horny spikes on their feet, but only the male ones have poison in them. Its main purpose is to destroy bacteria and viruses, but platypuses use it for defense more often. While they dive, the platypuses keep their eyes, ears and nostrils closed, and they rely solely on their sensitive beak, which they use to find food. It looks for food in the mud while it dives, and it feeds on small aquatic animals, such as snails, seashells, freshwater crabs and maggot larvae. The platypus keeps the food that it catches in small bags under its beak, and eats them only when it resurfaces from the water. Excess nutrients are kept in the tail in the form of fats.

Experimental group

Note. Pairs of contradictions are highlighted with the same color.

Practice block

Original (Serbian)

Meduze su uglavnom slobodno plivajuće životinje, sa telom u obliku zvona i dugačkim pipcima. One su životinje kod kojih se prvi put javlja nervni sistem, naravno, u najprostijem obliku – tzv. mrežast nervni sistem. Telo meduze ima samo dva sloja ćelija, između kojih se nalazi želatinozna masa, koja ih povezuje. Neke vrste meduza su vezane za morsko dno i nepokretne, a njihovi najbliži srodnici su morski krastavci, koji su prve životinje sa nervnim sistemom. Kod slobodno plivajućih meduza se u trećem sloju telesnih ćelija nalaze mišićna vlakna, koja izazivaju skupljanje i širenje tela i koja omogućavaju meduzi da neumorno pliva i lebdi u vodi.

Translation (English)

Jellyfish are mainly free-swimming animals, with a bell shaped body and long tentacles. They are the first animals with a nervous system, which is in its most rudimentary form - the so-called nerve net system. The body of the jellyfish has only two layers of cells, between which there's a gelatinous mass that ties them. Some types of jellyfish are tied to the riverbed and immovable, and their closest relatives are sea cucumbers, which are the first animals with a nervous system. Free-swimming jellyfish's third layer of cells contains muscle fibers that cause contraction and expansion of its body and allows for tireless swimming and floating in the water.

Main experimental block

Original (Serbian)

Kljunar ili čudnovati kljunar kako ga nekad zovu je mali, stidljivi sisar iz predela Australije i Tasmanije. Kljunari su isključivo slatkovodne životinje, koje žive u rukavcima reka obraslih drvećem. Na glavi s kratkim vratom ima širok pljosnat, krut i nesavitljiv kljun poput patke, koji hvata sićušne električne titraje koje odašilje njegov plen. Uši su mu bez ušnih školjki i ne može da ih zatvori, a kljunarima zubi potpuno ispunjavaju usnu šupljinu. I mužjaci i ženke kljunara su rođeni sa rožnatim ostrugama na šapama, ali samo mužjaci imaju otrov. Njegova funkcija je da uništi bakterije i viruse, ali kljunari mnogo više koriste svoj otrov za odbranu. Dok roni i lovi u moru, kljunar drži zatvorene oči i nozdrve, i oslanja se na svoj sluh, zatvarajući i otvarajući svoje uši radi preciznosti osluškivanja. Uz to, u pronalasku hrane mu pomaže i vrlo mekan i savitljiv kljun, a hrani se malim vodenim životinjama. Hranu koju ulovi, skladišti u kesama koje se nalaze iza kljuna i jede tek kada se vrati na površinu. Kako nema zube, u kljunu ima rožnate tvorevine koje mu služe kao sito i kojima stiskajući kljun mrvi hranu, dok ženke koriste svoj otrov da bi usitnile plen.

Translation (English)

The platypus, or the wondrous platypus as it is sometimes referred to is a small, shy mammal from the regions of Australia and Tasmania. The platypuses are exclusively freshwater animals that live in river distributaries that are covered with trees. On its head with a short and unpointed neck, the platypus has a stiff and inflexible duck-like beak, used for catching tiny electrical vibrations that are sent by its prey. Its ears have no auricles and they cannot be closed, and the platypus' oral cavity is completely filled with teeth. Both male and female platypuses are born with horny spikes on their feet, but only the male ones have poison in them. Its main purpose is to destroy bacteria and viruses, but platypuses use it for defense more often. While they are diving and hunting in the sea, the platypuses keep their eyes and nostrils closed, and they rely solely on their hearing, closing and opening their ears, which helps with listening precision. Additionally, in the search for food, it also relies on its very soft and flexible beak, and it feeds on small aquatic animals. The platypus keeps the food that it catches in small bags under its beak, and eats them only when it resurfaces from the water. As it has no teeth, it uses the horny formations in its beak to sift and crush food, while the females use their poison to shred their prey.

Study 2.2

Pilot study materials

Pair 1

Original (Serbian)

1. Sve se dešava sa razlogom.

2. Život je samo skup događaja koji se dešavaju nasumično, bez stvarne svrhe.

Translation (English)

1. Everything happens for a reason
2. Life is just a series of random events, happening without any real purpose.

Pair 2

Original (Serbian)

1. Svaki pojedinac ima slobodnu volju i sposobnost da upravlja svojom sudbinom.
2. Naši životi su unapred predodređeni i potpuno kontrolisani sudbinom.

Translation (English)

1. Every individual has free will and the ability to steer its destiny.
2. Our lives are predetermined and completely controlled by fate.

Pair 3

Original (Serbian)

1. Pravi partner te prihvata onakvog kakav si, bez želje da te menja.
2. Svaka veza mora da bude zasnovana na zajedničkom rastu, promeni i prilagođavanju drugoj osobi.

Translation (English)

1. A real partner accepts you the way that you are, without any desire to change you.
2. Every relationship should be built upon shared growth, change and adaptation to the other person.

Pair 4

Original (Serbian)

1. Suprotnosti se uvek privlače.
2. Ljudi se uvek uparuju sa sebi sličnima.

Translation (English)

1. Opposites always attract.
2. Like calls to like.

Pair 5

Original (Serbian)

1. Uvek treba biti spreman na najgore.
2. Najbitnije je uvek ostati optimističan i pozitivan u životu.

Translation (English)

1. You should always prepare for the worst.
2. It's important to always stay optimistic and positive in life.

Pair 6

Original (Serbian)

1. Uspeh zavisi isključivo od količine truda i rada koje uložiš.
2. Nema uspeha bez sreće i pravih okolnosti.

Translation (English)

1. Success depends solely on the amount of effort and work you put in.
2. There's no success without luck and right circumstances.

Pair 7

Original (Serbian)

1. Ljudi se danas uopšte ne bave svojom decom kao nekada.
2. Svi se danas previše bave decom i od njih prave nesposobne pojedince.

Translation (English)

1. People nowadays don't take care of their children like they used to.
2. Everyone is too involved with their children today, shaping them into incompetent individuals.

Pair 8

Original (Serbian)

1. Važno je ne ostajati zaglavljen u partnerskoj vezi kada se vidi da ne ide.
2. Ne treba olako napustiti vezu samo zato što trenutno ne ide.

Translation (English)

1. It's important not to get stuck in a romantic relationship if things are not working out.
2. You should not easily abandon a relationship just because things are not currently working out.

Pair 9

Original (Serbian)

1. Moderna tehnologija i društvene mreže su doveli do usamljenosti i nepovratnog otuđenja ljudi.
2. Uprkos granicama koje ih dele, ljudi nikada nisu bliži i povezaniji zahvaljujući modernoj tehnologiji.

Translation (English)

1. Modern technology and social media have brought about loneliness and irreversible alienation of people.
2. Thanks to social media, people have never been closer and more connected despite the borders that divide them.

Pair 10

Original (Serbian)

1. Intuicija je nepogrešiv vodič za donošenje odluka.
2. Treba sve odluke dobro razmotriti, iako ne deluju ispravno na prvu loptu.

Translation (English)

1. Intuition is an infallible guide for making decisions.
2. All decisions should be considered well, even though they might not seem right at a first glance.

Buffer pairs

Buffer pair 1

Original (Serbian)

1. Pojedinac je odgovoran za svoj uspeh.
2. Podrška zajednice igra važnu ulogu u uspehu pojedinca.

Translation (English)

1. Every person is responsible for their own success.
2. The support of their community plays an important role in a person's success.

Buffer pair 2

Original (Serbian)

1. Učenje iz grešaka je presudno za sopstveni razvoj.
2. Ljudi treba sebi da oprostite greške koje su načinili u prošlosti.

Translation (English)

1. Learning from one's own mistakes is crucial for personal development.
2. People should forgive themselves for their past mistakes.

Final study materials

Control group

Original (Serbian)

1. Organizmu treba obezbediti puno sna.
2. Treba voditi računa o svom zdravlju.
3. Bez obzira na izuzetke, u ljude generalno treba imati poverenja.
4. Deca treba učiti da pomažu prijateljima.
5. Treba čuvati prirodu.
6. Važno je kretati se što više.
7. Trud i posvećenost se uvek isplate.

Translation (English)

1. The organism needs a lot of sleep.
2. You should take care of your health.
3. People should be trusted, despite some exceptions.
4. Children should be taught to help their friends.
5. Nature should be taken care of.
6. It is important to be as active as possible.
7. Effort and dedication always pay off.

Experimental group

Pair 1

Original (Serbian)

3. Sve se dešava sa razlogom.
4. Život je samo skup događaja koji se dešavaju nasumično, bez stvarne svrhe.

Translation (English)

3. Everything happens for a reason
4. Life is just a series of random events, happening without any real purpose.

Pair 2

Original (Serbian)

3. Svaki pojedinac ima slobodnu volju i sposobnost da upravlja svojom sudbinom.
4. Naši životi su unapred predodređeni i potpuno kontrolisani sudbinom.

Translation (English)

3. Every individual has free will and the ability to steer its destiny.
4. Our lives are predetermined and completely controlled by fate.

Pair 3

Original (Serbian)

3. Uspeh zavisi isključivo od količine truda i rada koje uložiš.
4. Nema uspeha bez sreće i pravih okolnosti.

Translation (English)

3. Success depends solely on the amount of effort and work you put in.
4. There's no success without luck and right circumstances.

Pair 4

Original (Serbian)

3. Suprotnosti se uvek privlače.
4. Ljudi se uvek uparuju sa sebi sličnima.

Translation (English)

3. Opposites always attract.
4. Like calls to like.

Pair 5

Original (Serbian)

3. Uvek treba biti spreman na najgore.
4. Najbitnije je uvek ostati optimističan i pozitivan u životu.

Translation (English)

3. You should always prepare for the worst.
4. It's important to always stay optimistic and positive in life.

Buffer pairs

Buffer pair 1

Original (Serbian)

3. Pojedinac je odgovoran za svoj uspeh.
4. Podrška zajednice igra važnu ulogu u uspehu pojedinca.

Translation (English)

3. Every person is responsible for their own success.
4. The support of their community plays an important role in a person's success.

Buffer pair 2

Original (Serbian)

3. Učenje iz grešaka je presudno za sopstveni razvoj.

4. Ljudi treba sebi da oprostite greške koje su načinili u prošlosti.

Translation (English)

3. Learning from one's own mistakes is crucial for personal development.
4. People should forgive themselves for their past mistakes.

Supplement S5

Study 2.2 - Robustness analysis

In line with our preregistration, we excluded outliers and those participants who managed to reconcile more than three of our contradictory pairs of beliefs. We detected a total of 19 outliers that were more than three times the median absolute deviation ($3 \times \text{MAD}$) away from the median score (Leys et al., 2013), all of which were detected on the posttest of the experimental group. We next excluded $n = 87$ participants that were able to reconcile more than three pairs of contradictory beliefs from our stimuli list.

We checked again whether the two groups differed in how they evaluated the task. We found no significant differences on either the perception of the task's difficulty ($t(261.83) = 1.141, p = .255$; $M_{\text{control}} = 3.38, M_{\text{exp}} = 3.16$) or on how tiresome the task was ($t(263.93) = 1.772, p = .078$; $M_{\text{control}} = 3.48, M_{\text{exp}} = 3.11$). We did find significant differences for the assessment of how irritating the task was ($t(293.5) = 2.169, p = .031$; $M_{\text{control}} = 2.68, M_{\text{exp}} = 2.26$), so that those in the control group were more irritated by the task.

To test our hypothesis, we ran a two-way mixed ANOVA, with experimental manipulation as the between-subjects factor and time point as the within-subjects factor. Despite our expectations (H1), there was no significant interaction between the two factors - $F(1, 323) = 0.386, p = .535$, i.e. the manipulation did not reduce doublethink. We found no main effect of the experimental manipulation ($F(1, 323) = 2.216, p = .138$), but we did find a significant effect of time point ($F(1, 323) = 4.131, p = .043$), so that overall doublethink decreased on the posttest.

Study 2.3 - Robustness analysis

In line with our preregistration, we performed an outlier analysis. We detected a total of 3 outliers that were more than three times the median absolute deviation ($3 \times \text{MAD}$) away from the median score (Leys et al., 2013), all of which were detected on the pretest in the control group.

After removing the outliers, we ran a two-way mixed ANOVA, with experimental manipulation as the between-subjects factor and time point as the within-subjects factor. There was no significant interaction between the two factors - $F(1, 287) = 0.008, p = .930$, i.e. the manipulation did not reduce doublethink. We found no main effect of the experimental manipulation ($F(1, 287) = .020, p = .886$), but we did find a significant effect of time point ($F(1, 323) = 5.301, p = .022$), so that overall doublethink decreased on the posttest.

Supplement S6

Interview guide (original Serbian)

1. Predstavljanje i uvod u cilj studije (šta se krije iza toga kako ljudi odgovaraju na upitnike)
2. U upitniku koji ste popunjavali najpre ste odgovarali na neka pitanja o svojim stavovima, pa potom na neka pitanja koja se tiču toga kako posmatrate sebe, a onda ponovo neka pitanja o stavovima. Ti stavovi su se ticali na primer toga kako treba organizovati glasanje, ili toga kakva je ljudska priroda, o tome da li ljudi mogu da se menjaju ili slično.
3. Da li se sećate tih pitanja?
 1. Da li možete da pretpostavite šta procenjuju ove tvrdnje?
 2. Da li ste zapazili nešto u vezi sa ovim tvrdnjama?
4. Ispitanicima se potom prikazuje jedan od parova sa kojim su se složili, tvrdnja po tvrdnja.
 1. Da li se sećate šta ste odgovorili na ovu tvrdnju? Zašto?
 2. Da li se sećate šta ste odgovorili na ovu tvrdnju? Zašto?
5. Onda ih još jednom podsetimo na obe tvrdnje.
 1. Da li uočavate nešto u vezi odnosa ove dve tvrdnje?

Ukoliko uoče da su kontradiktorne sami, istaknemo im da može biti nedosledno da se slažu sa obe:

(a) Zašto ste se složili sa obe tvrdnje? Kako razumete odnos ovih tvrdnji?

Ukoliko ne uoče da su kontradiktorne, istaknemo im da jesu i da može biti nedosledno da se slažu sa obe.

(b) Zašto ste se složili sa obe tvrdnje? Kako razumete odnos ovih tvrdnji?

Interview guide (English translation)

1. Introductions and giving a general aim of the study (interest in how people fill out psychological questionnaires).
2. In the questionnaire you completed, you first answered some questions about your attitudes, then some questions about how you see yourself, and then again some questions about your attitudes. These beliefs included, for example, how voting should be organized, what human nature is like, whether people can change, and so on.
3. Do you remember these questions?
 1. Can you guess what these statements are assessing?
 2. Did you notice anything about these statements?
4. Respondents are then shown one of the pairs of statements with which they agreed, statement by statement.
 1. Do you remember what you answered for this statement? Why?
 2. Do you remember what you answered for this statement? Why?
5. Then we remind them once more of both statements.
 1. Do you notice anything about the relationship between these two statements?

If they notice that they are contradictory on their own, we point out that it may be inconsistent to agree with both:

- (a) Why did you agree with both statements? How do you understand the relationship between these statements?

If they do not notice that they are contradictory, we point out that they are and that it may be inconsistent to agree with both.

- (a) Why did you agree with both statements? How do you understand the relationship between these statements?

Chapter 5

General Discussion

Overall summary of findings

Doublethink and irrational beliefs

- Doublethink was correlated with representatives of all three types of irrational beliefs - pseudoscientific, paranormal and conspiratorial
- Not only that, but we found it to be especially predictive of the endorsement of contradictory conspiracy theories in the pandemic
 - It was also predictive of belief in contradictory conspiracies over and above other well-established markers of superficial information processing style

Doublethink and detrimental health consequences

- While doublethink was related to irrational beliefs, we found no evidence of it being predictive of questionable health behaviors (either intentional non-adherence to official medical recommendations or use of traditional, complementary and alternative medicine)
- We also found no evidence that those that use official and alternative medicine simultaneously were higher in doublethink, but we did however find that doublethink was related to the perception of official and alternative medicine as complementary
- We also found that doublethink was not related to trust in science, but those higher in doublethink were more likely to trust “the wisdom of the common man” i.e. to trust the wisdom of the average layperson
 - Doublethink also did not moderate the relation between trust in these two epistemic authorities

Doublethink and superficial information processing style

- Doublethink was consistently related to markers of superficial information processing style (including higher intuitive thinking style, pseudo-profound bullshit receptivity, and need for cognitive closure, and, expectedly, to lower actively open-minded thinking, cognitive reflection, and syllogistic reasoning)
- We repeatedly found no relation to rational thinking style

Doublethink and processing abilities

- Doublethink was consistently related to a lower ability to spot inconsistencies
- However, it showed no correlation to the executive function of shifting, and a weak correlation to the executive function of updating. This correlation was further non-significant once variables of superficial processing style were taken into account, suggesting that it is not a lack of cognitive resources that is driving the endorsement of contradictory beliefs

Interventions to reduce doublethink

- We tested three interventions to reduce the endorsement of contradictory beliefs that relied on the idea that when contradictions are made apparent, they will push people to revise their beliefs and avoid contradictions

- The interventions relied on facing people with inconsistencies in more or less direct ways by (1) training them to be more sensitive to contradictions in general, (2) instructing them to reconcile provided mutually incompatible beliefs and (3) explicitly demonstrating that their own beliefs are inconsistent
- None of the interventions had an effect on doublethink i.e. we saw no change when it was reassessed upon intervention in the experimental groups relative to the control

Spontaneous strategies to reconcile contradictory beliefs

- People acknowledge the contradictory nature of the beliefs they endorse
- However, they do not attach negative evaluations to that endorsement and instead, after acknowledging that the beliefs are contradictory, relatively easily generate explanations for how they can endorse both
- Post hoc adjustments of the strength of beliefs or their revision in order to overcome the contradictions is relatively rare
- Instead, people rely on various strategies to reconcile their personal contradictory beliefs: they rationalized their inconsistencies with the nuances of agreeing with an item on a rating scale (29% of total employed strategies) or they somehow reinterpreted the content of the the two contradictory statements (beliefs)
 - The most frequently used strategy in this category (34% of total employed strategies) was the introduction of additional unstated conditions to the claims, followed by the generation of biased examples that work as exemptions from the general rule (26%)
 - The participants also relied on chronological explanations (i.e., one claim being true at an earlier point in time than the other; 5%) and describing one claim as prescriptive and the other as descriptive (5%).

General discussion

Doublethink and irrational beliefs

First of all, our findings suggest that doublethink is not only reflective of conspiratorial beliefs, as was previously shown (e.g., Petrović & Žeželj, 2022), but extends to paranormal and magical health beliefs as well. It was additionally also the strongest predictor of contradictory conspiracy theories related to the pandemic. This suggests that, rather than it being a consequence of the specific content of conspiratorial beliefs, as suggested previously (Lewandowsky et al., 2016), this tolerance of contradictions might be a feature of the broader set of interrelated beliefs, i.e. the irrational mindset (Lazarević et al., 2023; Knežević et al., 2024). We argue that it can be an important mechanism that helps in forming and sustaining such a mindset. Paradoxically, doublethink seems to represent a belief system that is, simultaneously, both permissive and rigid. Less sensitivity to contradictory information allows the system to be less selective at the entrance point, but also to dismiss or rationalize disconfirming evidence later thus enabling it to be structurally self-validating (Boudry & Braeckman, 2012).

As for established consequences of irrational beliefs, such as the use of questionable health practices (Knežević et al., 2025; Lazarević et al., 2025; Purić et al., 2025), we did not find doublethink to be related to it. Moreover, we find that while doublethink (unlike irrational beliefs in general, see e.g. Rutjens & Većkalov, 2022) is not related to distrust in science, those higher on doublethink were

more likely to rely on the epistemic authority of the common man. The two epistemic authorities are not mutually exclusive - in fact, we repeatedly find no correlation between the two (Žeželj et al., 2023). However, this reliance on the epistemic authority of the common man or folk wisdom for those higher on doublethink might once more be taken as evidence of a more lenient epistemic filter (in one case by accepting incongruent beliefs and in the other by forgoing rigorous standards for expertise).

Doublethink and superficial information processing style

Our findings also highlight that doublethink is a part of a more intuitive, more disheveled approach to information processing. Interestingly, while its relation to intuitive thinking style seems to be relatively robust, we find no correlation between doublethink and rational thinking style across several studies. We initially conceptualized doublethink as a high entropy, highly permissive thinking style, in which any belief can be adopted even if it is contradictory to previously held beliefs (Petrović & Žeželj, 2022). If indeed a person can adopt any belief, even if it is not compatible with the rest of the belief system or at least some of its elements, this would suggest a belief system with highly permeable borders, in which “anything goes”. However, the findings of this research point to a more complex view of doublethink.

Firstly, we find that doublethink is positively related to the need for cognitive closure. As need for cognitive closure represents a need for quick and definitive solutions and resolvment of uncertainty (Webster & Kruglanski, 1994), its positive correlation to doublethink seems to suggest that doublethink also entails a certain degree of rigidity of the belief system. Secondly, we find that one of the strongest (negative) correlates of doublethink is actively open-minded thinking. Actively open-minded thinking is a form of epistemic self-regulation, reflected in the readiness to update beliefs with incoming new evidence (Stanovich & Toplak, 2023). This would also suggest a low flexibility of the belief system. This rigidity complicates the notion of doublethink as a high-entropy thinking style, because such a style would have to be more lenient and more tolerant of uncertainty. Instead, as mentioned, our results seem to reveal a paradoxical blend of permissiveness and inflexibility of doublethink. Third, we find a robust relation of doublethink to sensitivity to inconsistencies in neutral material, suggesting that those higher on doublethink are less likely to notice contradictions in general. Taken together, these findings highlight the dual (or contradictory, if you will) nature of doublethink - they seem to suggest a highly unstructured approach to information processing, but a rigid one at that. It could very well be that upon entry, for those high in doublethink, the belief system seems to be relatively permissive and porous, allowing for contradictory beliefs to be adopted indiscriminately, as a consequence of this tendency towards intuitive thinking, insensitivity to inconsistency and the mentioned lack of computational resources to constantly cross-reference beliefs (Sommer et al., 2023). However, the belief system of those more prone to inconsistent beliefs seems to also be relatively rigid - there is a reluctance to revise beliefs and a lack of cross-referencing of those beliefs. Once inside the system, beliefs are not updated with new incoming evidence and new beliefs are not cross-referenced with existing ones, leaving contradictory beliefs to thrive.

(In)consistency as a rational and computational imperative

In fact, across all samples, we find that endorsement of contradictory beliefs is substantial, with people who did not endorse any contradictory beliefs being very rare (ranging from 1.4% to 7.5% of the total samples) and with around four out of 11 pairs of contradictory beliefs being endorsed on average. This suggests that consistency is far from the default within the belief system. Our findings in this regard seem to follow contemporary findings from the belief revision literature. As already discussed, consistency might be impossible to sustain given the amount of central and

peripheral beliefs we hold and would have to cross-reference in order to maintain consistency with each and every one of them (Sommer et al., 2023). This is also adaptive, as some tolerance of inconsistency can reduce cognitive overload and might be particularly important in the current dynamic informational landscape. Being able to tolerate some sort of contradiction and to reason about it might also be a part of a rational process of belief revision (Gershman, 2019). We also show that this tendency to endorse contradictory beliefs is relatively robust - none of our interventions yielded a change in doublethink. One of the reasons why this happened might be that the core idea behind the interventions - that inconsistency can be frustrating or that it needs to be made apparent - is simply not true. Not only that, but in one of our experiments, where the participants' task was to try and explain how two contradictory beliefs can be simultaneously true, this experimental task was significantly *less* frustrating and difficult than the task that the control group had, which was just to generate similar beliefs to those supplied. Facing contradictions might not then be as frustrating as expected, so people need not go the distance to alter or abandon some of their beliefs. Moreover, what we learned from interviews is that the issue does not lie in the fact that people are not aware that the two beliefs they hold are contradictory. They might be less sensitive to such contradictions, but when faced with two contradictory beliefs they hold, side by side, they almost always acknowledge that the two beliefs are mutually inconsistent. They however attach no negative value to this state of affairs, or at least not in a way that signals to them that their beliefs need to be altered.

As an alternative, but only when prompted, they try to rationalize this inconsistency (Cushman, 2020). This rationalization includes adding onto or elaborating the beliefs in such a way that the inconsistency is made irrelevant - this was also reflected in the strategies we found the participants employed to explain their inconsistent beliefs. The most frequent strategy that emerged was the generation of additional logical conditions i.e. generation of additional beliefs or addendums to the belief that make the inconsistency possible. These additional logical conditions act as safeguards or belief buffers to the previously held beliefs (Gershman, 2019) thus leaving them intact. Instead of having to abandon beliefs when faced with inconsistency, especially beliefs that might be important to the person, we can generate auxiliary beliefs to justify the inconsistency. Similarly, another strategy that our participants relied on was the generation of biased examples that can justify each of the inconsistent beliefs. Explaining inconsistency as an exception to the rule of the more general belief, thus leaving that belief intact while allowing for the inconsistency to also be true (Khemlani & Johnson-Laird, 2012) has also been previously highlighted as a strategy to reason about inconsistency. Not only can explaining the inconsistencies make them sustainable, it can also make people less sensitive to them later on (Khemlani & Johnson-Laird, 2012). Additionally, rationalization calibrates beliefs so that the inconsistency becomes rational (Cushman, 2020). The qualitative portion of our research thus provided crucial insights to understanding of why the interventions were unsuccessful. The mixed-method approach can then be particularly valuable when exploring such complex dynamics of the belief system that manifest as doublethink.

As we have shown, the strategies to reconcile inconsistent beliefs and overcome doublethink are not just intellectual acrobatics nor are they purely irrational. It should be noted however that they are post hoc explanations that arise *only* when prompted. People might not be fully endorsing two completely opposite beliefs (or can give reasonable explanations as to why they are doing so when asked), but, in the absence of being pushed to explain that endorsement, they are tolerating a clear incompatibility. While we do not put any value judgment on the endorsement of contradictory beliefs, especially in light of our results, and while we acknowledge that some aspects of inconsistency can be reasonable, this does not mean it does not also lead to the formation of erroneous beliefs or does not have potentially worrisome consequences.

Limitations and Future research

While we relied on a range of studies employing diverse methodologies to ensure the robustness of our findings, the current research also has some important limitations that merit mention.

Firstly, as discussed in Chapter 4, one of the key strategies that the participants relied on when faced with their inconsistency is the response format. Participants often claimed that for example their choice of a 3 (on a 4-point scale) signals that they agree only with a part of the claim or that the moderate strength of their belief for one of the items in the pair justifies believing as strongly in the other item in the pair as well. As the construct demands it, we do binarize the participants' answers - to say that a person holds two contradictory beliefs, we have to categorize each of the items in the contradictory pairs as either held or not held by that particular person. We still opt to use a 4-point scale in order to leave participants with a more nuanced spectrum to position themselves on and to ease their choice between (mostly) believing something to be true or (mostly) not. Additionally, this still leaves the participants the option to be consistent in their moderate agreements (by for example choosing 3 on a scale for one belief in the pair and 2 for the other). Future studies could still test the use of a binary scale or use a stricter threshold for what is considered doublethink (i.e. keep the 4-point scale but treat only the extreme responses (so a 4) on both of the items in a pair as doublethink). We however opt to not do so in order to ensure more variability and reliability of the measure, and to represent different degrees of tolerance of inconsistency.

While the level of specificity of our explored constructs allows us to make some assumptions about the pathways between doublethink, irrational beliefs and questionable health behaviors, we still relied only on correlational studies when exploring these constructs, and have not tested whether doublethink indirectly contributes to the use of questionable health behaviors through irrational beliefs or the epistemic authority of the common man. Future studies could employ longitudinal design to better establish the causal links between the examined constructs. Longitudinal designs could also be employed to explore how doublethink is formed, and how pairs of contradictory beliefs relate to each other through time. Moreover, future studies can explain whether consistency through time and its perception are related to doublethink and in what ways. Similarly, instead of relying on participants' post hoc explanations of inconsistency, participants could be asked to explain why they hold the beliefs represented by each of the item in a contradictory pair as they are answering them. This could provide more insight into whether rationalization of inconsistency happens spontaneously as well.

Our experimental studies have shown that doublethink is resistant to change. Future interventions could focus on positioning inconsistency as undesirable, and exploring if that lowers doublethink. Inoculation interventions (see Banas & Rains, 2010 for a review) could be adapted to do exactly that, by first exposing people to, for example, some universal truths that are easily simultaneously accepted (like the ones in the doublethink scale) and then highlighting the risks of inconsistency and its problematic epistemic status (e.g. making people immune to counter arguments even when they are reasonable or encouraging biased reasoning). Moreover, given its stable correlations to different measures of superficial information processing, interventions that target those could be a potential avenue for the reduction of doublethink. For example, previous studies have shown that narrative norm-based inoculation techniques, in which actively open-minded thinking is highlighted as the descriptive norm, while also preemptively warning about the dangers of not being open minded, can enhance actively-open minded thinking (Biddlestone et al., 2024). It could be tested if this intervention (or even more direct one, e.g. labeling consistency as a norm) can also lower doublethink. Similarly, debiasing techniques have been shown to be successful in enhancing

reflective thinking (Bayrak et al., 2025; Isler & Yilmaz, 2022), which could also be used as a strategy to reduce doublethink.

While we focus here on exploring the inconsistencies within the system of irrational beliefs, there are other belief systems - such as ideological or moral belief systems - that can also harbor inconsistencies. As mentioned previously, this can manifest in the form of double standards for the majority and minority groups (for example, seeing expression of cultural identity by the majority group as a point of pride or patriotism, but seeing the same from the minority group as threatening or divisive). This tolerance of inconsistency may serve a system-justifying function (Jost & Banaji, 1994), helping to preserve existing social hierarchies. In fact, system justifying beliefs are often directly contradictory to a person's own self-interest and thus holding them requires a certain tolerance of inconsistency (e.g., for a woman, the belief that men are naturally predisposed to hold positions of power stands in contradiction to her personal identity; see Jost & Van Der Toorn, 2012 for an overview). Moreover, as mentioned, research already suggests that doublethink is robustly related to different measures of authoritarianism (Petrović et al., 2024; Petrović & Ninković, 2025). In addition, when it comes to groups that people are prejudiced against, it is easy to endorse mutually incompatible beliefs about that group as long as both beliefs are negative (e.g., migrants steal all our work but are also lazy and leech of our social support policies or Jews are unwilling to assimilate and simultaneously are too assimilative (as in Levinson & Sanford, 1944)). As ideological beliefs are usually core identity beliefs, people might adopt inconsistent beliefs as long as they are in line with their partisan view. Given that political beliefs are also formed based on the alliances we forge with others, they can be made of a sometimes inconsistent patchwork of beliefs (Pinsof et al., 2023). Future studies could then examine whether people are more sensitive to inconsistencies in statements coming from those ideologically misaligned with them rather than their ideological allies, possibly highlighting a motivated reasoning bias (e.g., Kahan, 2023) in detecting inconsistencies. Doublethink could also be a moderator of these effects. Taken together, these findings would suggest that examining inconsistent beliefs in the domain of ideology can be a fruitful endeavor.

Finally, in this research, we relied on samples from a single country. Future studies could then explore the cross-cultural invariance of doublethink, as well as the stability of its correlates across diverse sociocultural contexts. For example, some studies on cognitive polyphasia and dialectic thinking suggest a cross-cultural difference in tolerance and acceptance of contradictions (e.g., Jovchelovitch & Priego-Hernández, 2015; Peng & Nisbett, 1999), but an empirical examination of cross-cultural stability of individual differences in direct endorsement of contradictory beliefs still remains to be explored.

Key contributions and concluding remarks

To our knowledge, this is the first thorough and systematic examination of individual differences in doublethink i.e. in the endorsement of contradictory beliefs as a trait. Across a series of 11 empirical studies, combining different methodological approaches (three experimental, seven correlational and one qualitative study), and despite a body of work arguing for consistency as one of our central motives (e.g., Gawronski, 2012), we show that people can easily endorse incompatible beliefs, and that this tendency is psychologically meaningful and can be robustly assessed. We also demonstrate that it is not mere carelessness, but a form of tolerance of contradiction that is compatible with belief coherence maintenance - that is, the maintenance of previously held beliefs - even if this tolerance seems purely irrational on the surface. Such a mechanism can be neutral or even functional at times. Nonetheless, the thesis also highlights the importance of doublethink for predicting irrational beliefs, which can be particularly important given the range of negative consequences that these beliefs have been previously tied to (e.g., Imhoff et al., 2021; Knežević et al., 2024; Tam & Chan, 2023; Taschner et al., 2022).

It also positions doublethink as an important aspect of understanding belief systems in general. While it challenges the notion that consistency is the default in the belief system, it simultaneously calls into question that inconsistency necessarily implies chaos or disarray. Instead, this research seems to suggest that doublethink entails a certain rigidity of the belief system, one that allows inconsistencies to persist, while also enabling rational strategies of overcoming the inconsistencies when they are made salient.

From a broader perspective, this examination of a mindset tolerant of contradiction can be particularly useful given the information overload, political polarization and the shifting epistemic authorities that characterize contemporary societies. Understanding how people can readily endorse contradictory beliefs can offer insight into how misinformation persists despite correction or how evidence-based communication fails to provide intended belief or behavior change. Additionally, the examination of doublethink could potentially help tailor public communication to address the underlying mechanism that shapes belief resilience and help design interventions that increase epistemic vigilance i.e. the ability to successfully discern what information is reliable (Sperber et al., 2010), which is exercised through checking incoming information for consistency with beliefs and knowledge.

We hope that this research lays the groundwork and successfully argues for an inclusion of doublethink in understanding of rigid belief systems, such as irrational beliefs, misinformation, science denial or political polarization. Addressing doublethink in these and other contexts will however need to include more than just making the contradictions apparent, and instead really engage with what is epistemically valued in public discourse - while inconsistency may be inevitable and sometimes adaptive, there is still a question of which contradictions are tolerated and which are questioned.

Chapter 5 References

- Altemeyer, B. (1996). *The authoritarian specter*. Harvard University Press.
- Banas, J. A., & Rains, S. A. (2010). A Meta-Analysis of Research on Inoculation Theory. *Communication Monographs*, 77(3), 281–311. <https://doi.org/10.1080/03637751003758193>
- Bayrak, F., Sümer, V., Dogruyol, B., Saribay, S. A., Alper, S., Isler, O., & Yilmaz, O. (2025). Reflection predicts and leads to decreased conspiracy belief. *Cognition*, 258, 106085. <https://doi.org/10.1016/j.cognition.2025.106085>
- Biddlestone, M., Ziemer, C.-T., Maertens, R., Roozenbeek, J., & Van Der Linden, S. (2024). *Norm-Enhanced Prebunking for Actively Open-Minded Thinking Indirectly Improves Misinformation Discernment and Reduces Conspiracy Beliefs*. <https://doi.org/10.2139/ssrn.5000515>
- Cushman, F. (2020). Rationalization is rational. *Behavioral and Brain Sciences*, 43, e28. <https://doi.org/10.1017/S0140525X19001730>
- Gawronski, B. (2012). Back to the Future of Dissonance Theory: Cognitive Consistency as a Core Motive. *Social Cognition*, 30(6), 652–668. <https://doi.org/10.1521/soco.2012.30.6.652>
- Imhoff, R., Dieterle, L., & Lamberty, P. (2021). Resolving the Puzzle of Conspiracy Worldview and Political Activism: Belief in Secret Plots Decreases Normative but Increases Nonnormative Political Engagement. *Social Psychological and Personality Science*, 12(1), 71–79. <https://doi.org/10.1177/1948550619896491>
- Isler, O., & Yilmaz, O. (2022). How to activate intuitive and reflective thinking in behavior research? A comprehensive examination of experimental techniques. *Behavior Research Methods*, 55(7), 3679–3698. <https://doi.org/10.3758/s13428-022-01984-4>
- Jost, J. T., & Banaji, M. R. (1994). The role of stereotyping in system-justification and the production of false consciousness. *British Journal of Social Psychology*, 33(1), 1–27. <https://doi.org/10.1111/j.2044-8309.1994.tb01008.x>
- Jost, J. T., & Van Der Toorn, J. (2012). System Justification Theory. In P. Van Lange, A. Kruglanski, & E. Higgins, *Handbook of Theories of Social Psychology* (pp. 313–343). SAGE Publications Ltd. <https://doi.org/10.4135/9781446249222.n42>
- Kahan, D. M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*, 8(4), 407–424. <https://doi.org/10.1017/S1930297500005271>
- Khemlani, S. S., & Johnson-Laird, P. N. (2012). Hidden conflicts: Explanations make inconsistencies harder to detect. *Acta Psychologica*, 139(3), 486–491. <https://doi.org/10.1016/j.actpsy.2012.01.010>
- Knežević, G., Petrović, M. B., Ninković, M., Zupan, Z., Lukić, P., Purić, D., Živanović, M., Teovanović, P., Stanković, S., & Žeželj, I. (2024). Lifetime prevalence of questionable health behaviors and their psychological roots: A preregistered nationally representative survey. *PLOS ONE*, 19(11), e0313173. <https://doi.org/10.1371/journal.pone.0313173>
- Lazarević, L. B., Knežević, G., Purić, D., Teovanović, P., Petrović, M. B., Ninković, M., Živanović, M., Stanković, S., Branković, M., Lukić, P., Opačić, G., & Žeželj, I. (2023). Tracking variations in daily questionable health behaviors and their psychological roots: A

preregistered experience sampling study. *Scientific Reports*, 13(1), 14058.
<https://doi.org/10.1038/s41598-023-41243-w>

- Levinson, D. J., & Sanford, R. N. (1944). A Scale for the Measurement of Anti-Semitism. *The Journal of Psychology*, 17(2), 339–370. <https://doi.org/10.1080/00223980.1944.9917200>
- Peng, K., & Nisbett, R. E. (1999). Culture, dialectics, and reasoning about contradiction. *American Psychologist*, 54(9), 741–754. <https://doi.org/10.1037/0003-066X.54.9.741>
- Petrović, M. B., & Ninković, M. (2025). A specter is haunting political psychology - a specter of left-wing authoritarianism: Development and validation of left-wing authoritarianism scale in a post-communist society. *Political Psychology*. <https://doi.org/10.1111/pops.70053>
- Petrović, M. B., & Žeželj, I. (2022). Thinking Inconsistently: Development and Validation of an Instrument for Assessing Proneness to Doublethink. *European Journal of Psychological Assessment*, 38(6), 463–475. <https://doi.org/10.1027/1015-5759/a000645>
- Pinsof, D., Sears, D. O., & Haselton, M. G. (2023). Strange Bedfellows: The Alliance Theory of Political Belief Systems. *Psychological Inquiry*, 34(3), 139–160.
<https://doi.org/10.1080/1047840X.2023.2274433>
- Rutjens, B. T., & Većkalov, B. (2022). Conspiracy beliefs and science rejection. *Current Opinion in Psychology*, 46, 101392. <https://doi.org/10.1016/j.copsyc.2022.101392>
- Sommer, J., Musolino, J., & Hemmer, P. (2023). A hobgoblin of large minds: Troubles with consistency in belief. *WIREs Cognitive Science*, 14(4), e1639.
<https://doi.org/10.1002/wcs.1639>
- Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origgi, G., & Wilson, D. (2010). Epistemic Vigilance. *Mind & Language*, 25(4), 359–393. <https://doi.org/10.1111/j.1468-0017.2010.01394.x>
- Stanovich, K. E., & Toplak, M. E. (2023). Actively Open-Minded Thinking and Its Measurement. *Journal of Intelligence*, 11(2), 27. <https://doi.org/10.3390/jintelligence11020027>
- Tam, K.-P., & Chan, H.-W. (2023). Conspiracy theories and climate change: A systematic review. *Journal of Environmental Psychology*, 91, 102129.
<https://doi.org/10.1016/j.jenvp.2023.102129>
- Taschner, N. P., Orsi, C., Almeida, P., & Pilati, R. (2022). The impact of personal pseudoscientific beliefs in the pursuit for non-evidence-based health care. *Journal of Evidence-Based Healthcare*, 3, e3516. <https://doi.org/10.17267/2675-021Xevidence.2021.e3516>
- Webster, D. M., & Kruglanski, A. W. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology*, 67(6), 1049–1062.
<https://doi.org/10.1037/0022-3514.67.6.1049>
- Žeželj, I., Petrović, M., Ivanović, A., & Kurčubić, P. (2023). I trust my immunity more than your vaccines: “Appeal to nature” bias strongly predicts questionable health behaviors in the COVID-19 pandemic. *PLOS ONE*, 18(2), e0279122.
<https://doi.org/10.1371/journal.pone.0279122>

Biography

Marija Petrović was born on June 1, 1995, in Belgrade. She enrolled in undergraduate studies in psychology at the Faculty of Philosophy, University of Belgrade, in 2014, and graduated in 2018 with an average grade of 9.17. In the same year, she began her master's studies in psychology, which she completed in 2019 with an average grade of 10.00. She defended her master's thesis titled "*Tendency toward doublethink as a correlate of conspiracy beliefs*" under the supervision of Iris Žeželj. Since 2022, she has been employed as a researcher at the Faculty of Philosophy, University of Belgrade.

As a doctoral student, Marija has been engaged in teaching at the Department of Psychology since 2019 (Faculty of Philosophy, UB; courses Psychometrics 1 and 2). From January 2022 to January 2025, she was engaged on the project *Irrational mindset as a conceptual bridge from psychological dispositions to questionable health practices – Reason4Health*, funded by the Science Fund of the Republic of Serbia under the IDEAS program (#7739597). From 2023 to 2024, she also participated in the project *Studying human compliance with argumentation principles: Creating a rational-based framework for overcoming polarisation*, financed by the Ministry of Science, Technological Development and Innovation under the Pavle Savić program. She was part of the *Junior Researcher Programme*, serving as a scientific coordinator in the role of Research Officer for the 2023/24 cohort. In July 2023, she helped organize the summer school in Siena for programme participants, and in August 2024, she visited the University of Cambridge to organize and lead the programme's final conference. She is a recipient of the Kurt Lewin Institute Seedcorn grant for doctoral researchers, together with colleagues from the University of Amsterdam (UvA).

Marija is a member of the LIRA Laboratory at the Faculty of Philosophy, University of Belgrade. She is the first author and co-author of 19 scientific articles in the following categories: M21a+ (4), M21a (5), M21 (8), and M22 (2), as well as one book chapter in a thematically edited volume of international significance (M14), and over 40 conference presentations, published either in full or as abstracts (M33–M34). Her research interests lie in social psychology, especially in the domains of belief system structure, irrational and political beliefs, and health behaviors.

She is a member of the European Association of Social Psychologists (EASP) and the International Society of Political Psychology (ISPP). She serves as a Junior Consulting Editor at the *European Journal of Social Psychology* and has reviewed manuscripts for international journals including *European Journal of Social Psychology*, *Applied Psychology: Health and Well-Being*, *Thinking and Reasoning*, *Digital Health*, *Psychological Reports*, and *Studia Psychologica*. Marija is also actively involved in science communication.

Изјава о ауторству

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