SWPS Uniwersytet Humanistycznospołeczny

Wydział Psychologii we Wrocławiu

Kamil Izydorczak

COMPARATIVE JUDGMENTS IN THE TIME OF THE COVID-19 PANDEMIC – MAGNITUDE, DIRECTION, AND PSYCHOLOGICAL MECHANISMS OF PANDEMIC-RELATED SELF-OTHERS COMPARISONS

Oceny porównawcze w czasach pandemii COVID-19 – nasilenie, kierunek oraz psychologiczne mechanizmy specyficznych dla pandemii porównań „ja – inni”

Rozprawa doktorska przygotowana pod kierunkiem

prof. dr hab. Dariusza Dolińskiego

Wrocław, 2023

Szczególne podziękowania dla osób, które pomogły mi na początku naukowej drogi: Katarzyny Cantarero i Tomasza Grzyba oraz dla tych, których kroczyli nią wraz z ze mną: Aleksandry Kosiarczyk, Rafała Węgrzyna oraz Pawła Muniaka.

Pracę dedykuję Marii i Julii Izydorczak – dwóm niezrównanym kobietom.

Spis treści

Streszczenie....4

Abstract....7

Autoreferat....10

Spis prac naukowych wchodzących w skład rozprawy....33

Oświadczenia współautorów prac wchodzących w skład rozprawy....34

Artykuł 1....39

Artykuł 2....57

Artykuł 3....75

Artykuł 4....95

Streszczenie

Niniejsza rozprawa prezentuje serię czterech artykułów – trzech opublikowanych oraz jednego złożonego do publikacji. Artykuły przedstawiają sześć badań zrealizowanych w latach 2020-2023 a ich wspólnym rdzeniem tematycznym są oceny porównawcze dokonywane na osiach "ja" - "inni" oraz "my" - "oni". Porównanie te dokonywane były w kontekście pandemii COVID-19 i dotyczyły ściśle powiązanych z nią obszarów – ryzyka zachorowania na COVID-19, intencji zaszczepienia przeciwko tej chorobie a także postrzegania zwolenników i przeciwników szczepień. Badania zrealizowane zostały w metodologii ilościowej przy zastosowaniu planów korelacyjnych oraz eksperymentalnych a także badań podłużnych oraz meta-analizy.

Wszystkie artykuły zostały opublikowane lub złożone do publikacji w międzynarodowych czasopismach z listy JCR – *Collabra: Psychology*, *PLOS ONE* oraz *Royal Society Open Science.*

Pierwszy artykuł - „Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement", opisuje pre-rejestrowany eksperyment, którego celem było sprawdzenie zasadności metodologicznych oraz etycznych zastrzeżeń formułowanych pod adresem metody pomiaru jawnej dehumanizacji – *Ascent of Humans.* Chcieliśmy przekonać się, czy wyniki pomiaru nie są artefaktami wizualnych elementów kwestionariusza oraz czy odpowiadanie na pytania w tym kwestionariuszu nie wpływa negatywnie na postawy wobec grup objętych pytaniami. Oba zarzuty nie zyskały empirycznego potwierdzenia a badanie pozwoliło odkryć istotną cechę pomiaru *Ascent of Humans.* Kluczowe dla tego pomiaru okazuje się rozróżnienie pomiędzy wynikami wskazującymi na pełen stopień człowieczeństwa a pozostałymi wyniki. Rozkład wyników *Ascent of Humans* nie tworzy ilościowej ciągłości, lecz dwie kategorie.

Drugi artykuł - „Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic" prezentuje wyniki podłużnych badań nierealistycznego optymizmu wśród mieszkańców Polski podczas pierwszego roku pandemii COVID-19. Uczestnicy badania proszeni byli w 16 kolejnych pomiarach o oszacowanie ryzyka

zarażenia się wirusem SARS-CoV-2 przez nich samych oraz przez przeciętnych rówieśników. Wyniki świadczą o tym, że zjawisko nierealistycznego optymizmu (przekonanie o niższych szansach zakażenia dla „mnie" w porównaniu z „innymi") pojawiło się dopiero po pierwszym stwierdzonym przypadku COVID-19 w Polsce a następnie utrzymywało się przez cały pierwszy rok pandemii, ze zmienną intensywnością. Intensywność ta w bardzo niewielkim stopniu korelowała z obiektywnymi miarami rozwoju pandemii – liczbą zakażeń oraz śmierci w wyniku COVID-19. Poziom nierealistycznego optymizmu nie wiązał się także ze stopniem fizycznej izolacji od innych ludzi. Okazał się za to wiązać ze względną intensywnością rządowych obostrzeń pandemicznych. Gdy obostrzenia były nasilane, nierealistyczny optymizm wzrastał. Gdy obostrzenia były znoszone - spadał.

Trzeci artykuł - „Do unbiased people act more rationally?—The case of comparative realism and vaccine intention" przedstawia serię trzech badań, których celem było zgłębienie relacji pomiędzy nierealistycznym optymizmem wobec zarażenia się SARS-CoV-2 a intencją zaszczepienia się przeciwko COVID-19. Pierwsze badanie – mini meta-analiza zgromadzonych przez nasz zespół badawczy danych, wskazywała na zaskakujące wnioski. Osoby pozbawione porównawczej stronniczości (nie wykazujące ani nierealistycznego optymizmu ani pesymizmu), cechowały się najniższą intencją zaszczepienia. Kolejne dwa pre-rejestrowane badania potwierdziły ten efekt oraz wykazały, że porównawczy realizm oraz intencja zaszczepienia nie wiążą się z wewnętrznym umiejscowieniem kontroli (*internal locus of control*) ani potrzebną kontroli (*desirability for control*). Zarówno poznawczy realizm jak i niższa intencja zaszczepienia okazały zaś wiązać się z bardziej wyrównanym postrzeganiem zagrożenia chorobą COVID-19 oraz zagrożenia szczepionką przeciwko niej.

Czwarty artykuł - „Vaccine Skeptics and Vaccine Enthusiasts: What is the Intergroup Wall Made of?" opisuje pre-rejestrowane badanie złożone do recenzji w formie "Registered Reports". Celem badania było sprawdzenie, czy postawy wobec szczepionki przeciwko COVID-19 będą czynnikiem

grupo-twórczym – inaczej mówiąc, czy na bazie tych postaw mogą uformować się procesy faworyzacji grupy własnej oraz uprzedzeń wobec grupy obcej.

Okazało się, że zwolennicy oraz przeciwnicy szczepionek przeciwko COVID-19 wyraźnie faworyzują grupę własną. Znajduje to wyraz nie tylko w żywionych wobec grupy własnej i obcej uczuciach ale także w wyraźnej preferencji kontaktu online i offline z osobami o zgodnych poglądach.

Ponadto wykazaliśmy, że bardziej subtelne formy dehumanizacji (*dual-model dehumanization*) występują rzadziej, natomiast skrajne formy dehumanizacji (*blatant dehumanization* oraz *direct dehumanization)* znacznie częściej. Poziom intensywności uprzedzeń oraz wrogości pomiędzy zwolennikami i przeciwnikami szczepionek okazuje się być zbliżony do intensywności negatywnych postaw Polaków wobec Romów. Niechęć ta jest obustronna, jednak nieco silniejsza ze strony zwolenników szczepień.

Przedstawiona seria artykułów prezentuje badania nad konstruktami teoretycznymi wywodzącymi się z różnych tradycji psychologicznych oraz rozwijanymi w ramach różnych obszarów specjalizacji – mowa tu o nierealistycznym optymizmie i dehumanizacji. Łącząc je jednak w jednym kontekście (pandemii COVID-19), możliwym było wszechstronne sportretowanie wielu aspektów psychologicznego funkcjonowania ludzi w pandemii. Ponadto, dzięki dostrzeżeniu wspólnych cech w założeniach teoretycznych oraz sposobach pomiaru obu tych konstruktów, możliwe było zaproponowanie istotnych innowacji w zakresie statystycznych analiz oraz interpretacji wyników uzyskiwanych w ramach pomiaru nierealistycznego optymizmu i dehumanizacji.

Abstract

This dissertation presents a series of four articles—three published and one submitted for publication. The articles present six studies carried out between 2020 and 2023 and their common thematic core is the comparative assessments made along the axes of "me" - "others" and "us" - "them." These comparisons were made in the context of the COVID-19 pandemic and concerned context-specific topics—the risk of contracting COVID-19, intentions to be vaccinated against the disease, and perceptions of proponents and opponents of vaccination. The research was carried out in quantitative methodology using correlational and experimental designs as well as longitudinal studies and meta-analysis.

All articles were published or submitted for publication in international JCR-listed journals - *Collabra: Psychology*, *PLOS ONE*, and *Royal Society Open Science.*

The first article, "Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement," describes a pre-registered experiment designed to test the validity of methodological and ethical concerns formulated against the *Ascent of Humans* method of measuring blatant dehumanization. We wanted to test whether the results of the measurement are not artefacts of the visual elements of the questionnaire and whether answering the questionnaire negatively affects attitudes toward the groups covered by the questions. Both objections have not received empirical confirmation. Moreover, the study has uncovered an important feature of the *Ascent of Humans* measurement. A crucial aspect of this measurement turns out to be the distinction between scores indicating a full degree of humanity and the remaining scores. The distribution of *Ascent of Humans* scores does not form a quantitative continuum, but rather two categories.

The second article, "Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic," presents the results of a longitudinal study of unrealistic optimism among Polish residents during the first year of the COVID-19

pandemic. Participants in the study were requested to estimate the risk of contracting the SARS-CoV-2 virus by themselves and by average peers in 16 consecutive measurements. The results show that the phenomenon of unrealistic optimism (the belief that there is a lower chance of infection for "me" compared to "others") emerged only after the first identified case of COVID-19 in Poland and then persisted throughout the first year of the pandemic, with varying intensity. This intensity showed scant correlation with objective measures of pandemic progress - the number of infections and COVID-19 deaths. The level of unrealistic optimism was also unrelated to the degree of physical isolation from other people. Instead, it proved to be associated with the relative intensity of government pandemic restrictions. When the restrictions were tightened, unrealistic optimism increased. When the restrictions were lifted—it fell.

The third article - "Do unbiased people act more rationally?-The case of comparative realism and vaccine intention" presents a series of three studies that aimed to explore the relationship between unrealistic optimism about contracting SARS-CoV-2 and the intention to be vaccinated against COVID-19. The first study - a mini meta-analysis of the data collected by our research team - pointed to surprising conclusions. Individuals devoid of comparative bias (showing neither unrealistic optimism nor pessimism) had the lowest intention to vaccinate. Another two pre-registered studies confirmed this effect and showed that comparative realism and vaccination intention were not associated with an *internal locus of control* or *desirability for control*. In contrast, both cognitive realism and lower intention to vaccinate were associated with more equal perceptions of COVID-19 disease risk and COVID-19 vaccine risk.

The fourth article, "Vaccine Skeptics and Vaccine Enthusiasts: What is the Intergroup Wall Made of?" describes a pre-registered study submitted for review as *Registered Report*. We aimed to test whether attitudes toward the COVID-19 vaccine would be a group-creating factor - in other words, whether these attitudes could form the basis for ingroup favoritism and prejudice towards the outgroup.

It turned out that supporters and opponents of COVID-19 vaccines favor their ingroup. This was reflected in the feelings toward ingroup and outgroup, but also a clear preference for online and offline contact with people with compatible views.

In addition, we showed that more subtle forms of dehumanization (*dual-model dehumanization*) occurred less frequently, while extreme forms of dehumanization (*blatant dehumanization* and *direct dehumanization*) occurred much more frequently. The level of intensity of prejudice and hostility between supporters and opponents of vaccines turns out to be similar to the intensity of negative attitudes of Poles toward Roma. The resentment is mutual, but slightly stronger on the part of vaccine supporters.

The submitted series of articles describes studies concerning theoretical constructs (unrealistic optimism and dehumanization) derived from different psychological traditions and developed within different subfields. However, by combining them in one context (the COVID-19 pandemic), it was possible to comprehensively portray many aspects of the psychological functioning of people during the pandemic. In addition, by noticing commonalities in the theoretical assumptions and ways of measuring the two constructs, it was possible to propose important innovations in statistical analysis and interpretation of the unrealistic optimism and dehumanization measurements.

Autoreferat

Wprowadzenie oraz ramy teoretyczne programu badawczego

Rdzeń przedstawionego programu badawczego stanowią trzy artykuły prezentujące badania zrealizowane w okresie pandemii COVID-19. Badania te eksplorują zagadnienia psychologiczne ściśle związane z kontekstem pandemii – oceny porównawcze w obszarze ryzyka zachorowania na COVID-19, intencję zaszczepienia przeciwko COVID-19 oraz wzajemne uprzedzenia pomiędzy zwolennikami a przeciwnikami szczepień. Czwarty artykuł prezentuje badanie wykonane przed pandemią, które budowało metodologiczne fundamenty oraz stanowiło punkt odniesienia dla interpretacji części pozostałych wyników badań.

Przedstawiona seria artykułów, pomimo swojego silnego osadzenia w kontekście trwającej pandemii, porusza zagadnienia teoretyczne oraz metodologiczne o szerszym znaczeniu. Konstruktami teoretycznymi, na których koncentruje się prezentowana praca badawcza są *nierealistyczny optymizm* oraz *dehumanizacja.*

Nierealistyczny optymizm to przekonanie, że pozytywne zdarzenia przytrafiają się częściej mi, niż innym osobom, negatywne zaś rzadziej mi, niż innym osobom (*„believe that negative events are less likely to happen to them than to others, and they believe that positive events are more likely to happen to them than to others.”* - Weinstein, 1980, s. 807). Dehumanizacja z kolei to zjawisko definiowane (i mierzone) w ramach psychologii społecznej na wiele sposobów i jak dotąd nie doczekało się spójnego, jednolitego ujęcia teoretycznego (zob. (Haslam i Stratemeyer, 2016). Dla potrzeb owej pracy, posługiwać się będę najszerszą definicją, w obrębie której mieszczą się wszystkie stosowane przeze mnie miary dehumanizacji. Będę ją rozumieć jako *częściowe lub całościowe odmawianie członkom grupy obcej cech prototypowo ludzkich*.

Nierealistyczny optymizm i dehumanizacja, chociaż rzadko ze sobą zestawiane, mają wspólny podstawowy rdzeń – zasadzają się mianowicie na (zazwyczaj korzystnych dla podmiotu) porównaniach pomiędzy sobą a innymi ludźmi. Uwidacznia się to zwłaszcza na poziomie operacyjnym. Do stwierdzenia

zarówno dehumanizacji jak nierealistycznego optymizmu używa się bardzo podobnych procedur pomiaru – porównuje się sądy respondentów, formułowane w odniesieniu do siebie samych (grupy własnej) z sądami o analogicznej treści, formułowanymi w odniesieniu do innych ludzi (lub grup). To właśnie specyficzny wynik tych porównań, bardziej korzystny dla „siebie"/"nas" niż „innego"/"innych", świadczyć ma o wystąpieniu zjawiska nierealistycznego optymizmu bądź dehumanizacji.

Kolejną cechą łączącą te konstrukty jest fakt, że w obu przypadkach dokonywane przez podmiot porównania bazują raczej na wyobrażeniach niż realnej wiedzy. W przypadku nierealistycznego optymizmu czy dehumanizacji, jednostka nie ma dostępu do obiektywnego zestawu danych o sobie i innych. Często zresztą dane takie są z definicji nieosiągalne, dotyczą bowiem abstrakcyjnych pojęć takich jak „stopień człowieczeństwa". Porównania dokonywane w ramach nierealistycznego optymizmu czy dehumanizacji dokonują się zatem na podstawie subiektywnych przesłanek, w ramach wyobrażeniowego zadania mentalnego. Stanowią przez to nie tyle odzwierciedlenie rzeczywistości, co raczej emanacje nie zawsze w pełni uświadomionych postaw, potrzeb, emocji, czy błędów poznawczych.

Poza podobieństwami pomiędzy dehumanizacją a nierealistycznym optymizmem, wskazać można także kluczową różnicę. Porównania w ramach nierealistycznego optymizmu odbywają się na poziomie międzyjednostkowym – najczęściej pomiędzy „ja" a „innym, podobnym do mnie", rzadziej pomiędzy „ja" a „przeciętnym przedstawicielem mojej grupy". Porównania w ramach dehumanizacji odbywają się zaś na poziomie międzygrupowym, na osi „grupa własna" (lub „przeciętny przedstawiciel grupy własnej) a „grupa obca" („przeciętny przedstawiciel grupy obcej"). Warto również zaznaczyć, że oba pojęcia odwołują się do różnych psychologicznych tradycji i badacze posługujący się nimi, identyfikują się z różnymi subdyscyplinami psychologii społecznej.

Badania nad nierealistycznym optymizmem wywodzą się z badań nad zniekształceniami poznawczymi. W pionierskim artykule wprowadzającym pojęcie nierealistycznego optymizmu do psychologii społecznej (Weinstein, 1980), autor przywołuje wielokrotnie klasyczne już dzisiaj prace Tverskiego i Kahnenama (Tversky & Kahneman, 1973, 1974) dotyczące błędów i tendencyjności ocen

poznawczych. Przede wszystkim w takich kategoriach rozpatruje Weinstein zjawisko nierealistycznego optymizmu. Poza wątkami czysto poznawczymi, uwzględnia on jednak potencjalną rolę owych zniekształceń dla motywacji i emocji jednostki. Omawiając potencjalną rolę nierealistycznego optymizmu w utrzymaniu dobrego samopoczucia czy procesie radzenia sobie ze stresem, autor otwiera ścieżkę do eksploracji tego zjawiska w ramach psychologii zdrowia oraz psychologii klinicznej. Ścieżka ta została z resztą w pełni wykorzystana – w ponad 40 letniej historii badań nad nierealistycznym optymizmem chętnie eksplorowano to zagadnienie w ramach tych specjalizacji (zob. Clarke i in., 2000). Zjawisko to analizowane jest także w obriębie licznych nurtów stosowanej psychologii społecznej.

Badania nad dehumanizacją w psychologii społecznej mają nieco krótszą tradycję, chociaż samo słowo oraz powiązane z nim znaczenia są niezwykle mocno osadzone w tradycji filozoficznej i historycznej. Początki systematycznych badań oraz pomiaru zjawiska dehumanizacji w znaczeniu współcześnie używanym w psychologii społecznej sięgają początków XXI wieku. Wywodzą się zprac Leyensa oraz zespołu (Leyens i in., 2000) nad przypisywaniem zdolności do odczuwania złożonych emocji grupie własnej i obcej. Inni badacze podążyli podobnym co Leyens tropem, najpierw wyodrębniając jakąś właściwość lub zestaw właściwości charakterystycznych dla „człowieczeństwa", a następnie tworząc narzędzia pomiaru, przy pomocy których osoby oceniały grupę własną i grupę obcą względem tych kryteriów. Badania nad dehumanizacją uprawiane są najczęściej w ramach psychologii uprzedzeń i relacji międzygrupowych oraz psychologii politycznej. Nie brakuje jednak prób przeszczepienia ich na inne grunty, np. psychologii organizacji czy psychologii rozwoju człowieka.

Pomimo odrębnych obszarów tematycznych i osobnej genezy, nurty badań nad dehumanizacją i nierealistycznym optymizmem łączy wiele wspólnych elementów. Oba nurty opierają swoje wnioski na wyobrażeniowych porównaniach „ja" – „inni", oba nurty stosują przy tym metody kwestionariuszowe o zbliżonej strukturze, wreszcie w obu nurtach dominują odkrycia ujawniające uniwersalną tendencję do stawiania siebie w lepszym świetle. Z tych powodów zarówno dehumanizację jak i nierealistyczny optymizm, ujmować można jako szczególne przypadki szerszego psychologicznego zjawiska - sądów

porównawczych. Postuluję przy tym, że wspólne badanie tych zjawisk, z uwzględnieniem analogicznych wyzwań dotyczących pomiaru i interpretacji wyników, może pomóc lepiej zrozumieć ich uwarunkowania oraz skutki. Zwłaszcza jeśli, tak jak w przypadku przedstawionej serii artykułów, oba zjawiska badane są w tym samym kontekście psychologicznym.

Poza wspólnymi wątkami teoretycznymi (sądy porównawcze), serię artykułów łączą także dwa wątki metodologiczne. Pierwszym z nich jest wnikliwe badanie rozkładów częstości omawianych zmiennych i odkrywanie w owych rozkładach zjawiska punktowej inflacji wyników (zjawisko znacząco częstszego występowania konkretnych, pojedynczych wartości zmiennej, które wyróżniają się na tle całego rozkładu). Drugim wątkiem, ściśle wynikającym z pierwszego, jest odchodzenie od tradycyjnego traktowania badanych zmiennych jako ciągłych, wprowadzając w zamian wyodrębnione empirycznie i teoretycznie kategorie. Dzięki temu zabiegowi całkowity brak porównawczej tendencyjności (czyli traktowanie na równi siebie i innych) analizowany jest jako osobne zjawisko, a nie jedynie jako punkt na skali dehumanizacji czy nierealistycznego optymizmu.

Badania składające się na przedstawioną w ramach dysertacji serię artykułów łączy także przywiązanie do praktyk otwartej nauki. Wszystkie surowe bazy danych, materiały badawcze, a także pliki oraz kody umożliwiające reprodukcję statystycznych analiz oraz wizualizacji, udostępnione są publicznie i składane były do recenzji wraz z artykułami. Wszystkie prezentowane artykuły opublikowane zostały w otwartym dostępie. Poza samymi tekstami, czytelnicy mają także pełną możliwości wglądu w historię recenzji każdego artykułu. Spośród 6 prezentowanych badań, 4 zostały także pre-rejestrowane a jedno z pre-rejestrowanych badań realizowane było w procedurze Registered Report (projekt badania a także wstęp oraz rozdział metodologiczny artykułu, złożone zostały do recenzji przed zebraniem danych i uzyskały „in-principle acceptance", czyli deklaracje przyjęcia artykułu do druku po zrealizowaniu badań zgodnie z planem).

Prezentowane badania zrealizowane zostały z użyciem różnorodnych metodologii obejmujących jedno badanie eksperymentalne, jedno badanie podłużne wraz z analizą danych zastanych, jedną meta-

analizę oraz trzy badania korelacyjne. W przedstawionej pracy dominują metody ilościowe, jednak w przypadku Artykułu 3 zostały także wzbogacone o element metodologii jakościowej (STM – structural topics model). Badania przeprowadzone zostały na różnorodnych próbach, których liczebność oparta była (poza badaniem podłużnym) na uprzedniej analizie mocy testów statystycznych. Badani rekrutowani byli z międzynarodowej populacji (trzy badania), populacji polskiej (dwa badania) oraz populacji mieszkańców Polski, RPA oraz Stanów Zjednoczonych (jedno badanie). Dane do wszystkich badań zbierane były online.

Podsumowanie rezultatów badań

W tej sekcji omówię problemy badawcze oraz wnioski płynące z badań przedstawionych w serii przedłożonych artykułów. Kolejność przedstawionych artykułów odpowiada chronologicznemu porządkowi w jakim realizowane były badania.

Artykuł 1: Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement

Pierwszym artykułem z zaprezentowanej serii jest praca "Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement" (Izydorczak, Grzyb, i in., 2022). Celem przedstawionego w artykule badania było po pierwsze sprawdzenie, czy pomiar jawnej dehumanizacji metodą *Ascent of Humans* (Kteily i in., 2015) nie jest wadliwy. Planowaliśmy sprawdzić, czy wynik owego pomiaru nie jest artefaktem peryferyjnych cech konstrukcji internetowego kwestionariusza: sposobu wyświetlania porównywanych grup oraz początkowego umiejscowienia suwaka na skali. Drugie pytanie badawcze dotyczyło kwestii jednocześnie metodologicznej i etycznej – czy zaangażowanie osób badanych w udzielanie odpowiedzi na skali *Ascent of Humans* nie prowadzi u nich do zwiększenia poziomu uprzedzeń?

Zespół badawczy postawił twierdzące hipotezy w odniesieniu do obu problemów – przewidywaliśmy, że peryferyjne cechy konstrukcji kwestionariusza będą miały istotny wpływ na wynik pomiaru *Ascent of Humans* oraz, że udzielanie odpowiedzi na tej skali skutkować będzie pogorszeniem postawy w stosunku do grup objętych pomiarem. Aby zweryfikować postawione

hipotezy, zaprojektowaliśmy procedurę eksperymentalną, w której manipulowaliśmy obecnością pomiaru *Ascent of Humans* oraz peryferyjnymi cechami tego narzędzia.

Żadna z naszych hipotez nie potwierdziła się. Dzięki analizom Bayesowkim, możemy mówić nie tylko o niepotwierdzeniu hipotez, ale także o istotnych dowodach na brak wpływu warunków eksperymentalnych na badane zmienne. Peryferyczne cechy pomiaru *Ascent of Humans* okazały się nie wpływać istotnie na wynik pomiaru a odpowiadanie na pytania w tej skali pozostawało bez wpływu na odbiór obcych grup, których dotyczyły pytania. Dzięki wynikom tych konfirmacyjnych analiz wykazaliśmy, że nasze metodologiczne oraz etyczne zastrzeżenia odnośnie metody *Ascent of Humans* nie znajdują potwierdzenia w rzeczywistości. Otworzyło to drogę do zastosowania tej metody w czwartym artykule z przedstawionej serii.

Poza pre-rejestrowanymi analizami konfirmacyjnymi, przeprowadziliśmy także szereg badań eksploracyjnych, z których wypłynęły wnioski istotne dla dalszej linii badań. Po pierwsze wykazaliśmy, że w przypadku pomiaru *Ascent of Humans*, mamy do czynienia z wyraźną inflacją wyników świadczących o zupełnym braku dehumanizowania badanych grup obcych (zobacz: *Figure 4*, Izydorczak, Grzyb, i in., 2022). Po drugie zaś odkryliśmy, że jawna dehumanizacja mierzona tą skalą bardzo ściśle koreluje z generalnym poziomem uprzedzeń czy wręcz wrogości wobec obcych grup.

Wykazaliśmy, że w zależności od badanej grupy, od 30 do 52% respondentów nie ujmowało jej człowieczeństwa w najmniejszym nawet stopniu. Z drugiej zaś strony, własna grupa odniesienia wcale nie cieszyła się uniwersalną, pełną humanizacją – ponad 50% respondentów wskazywało na niepełne człowieczeństwo członków grupy własnej. Ponadto rozkład wyników, które nie wskazywały na pełne człowieczeństwo był wielomodalny, z wyraźną koncentracją wokół tych wartości, nad którymi umieszczono sylwetki ilustrujące skalę suwakową (zobacz: *Figure 1*, Izydorczak, Grzyb, i in., 2022). Taki rozkład wyników sugeruje, że najbardziej kluczowe w odpowiedziach respondentów jest rozróżnienie pomiędzy pełnym a niepełnym człowieczeństwem.

Wskazywanie pełnego człowieczeństwa (lub też porównawczo – człowieczeństwa na tym samym poziomie u grupy własnej i obcej) jest zachowaniem odrębnym jakościowo (a nie tylko ilościowo), podobnie jak wskazanie „zero" w pytaniu o liczbę wypalanych dziennie papierosów stanowi odrębną kategorię w stosunku do wskazania odpowiedzi „jeden" lub więcej (zob. Green, 2021).

Odkrycie nadreprezentacji wyników świadczących o braku dehumanizacji przełożyło się na zastosowanie dychotomicznego ujęcia tego zjawiska w badaniu z Artykułu 4 („Vaccine-skeptics and vaccine-enthusiasts: What is the intergroup wall made of?"). Stanowiło ono także inspirację do wykrycia analogicznej prawidłowości w odniesieniu do nierealistycznego optymizmu, co stało się podstawą serii badań przedstawionych w Artykule 3 („Do unbiased people act more rationally?—The case of comparative realism and vaccine intention"). Odkrycie ścisłego związku pomiędzy jawną dehumanizacją a generalnymi uprzedzeniami i wrogością pozwoliło zaś na postawienie hipotez oraz interpretacje wyników przedstawionych w Artykule 4.

Artykuł 2: Temporal Aspects of Unrealistic Optimism and Robustness of this Bias: A Longitudinal Study in the Context of the COVID-19 Pandemic

Drugi artykuł w serii – "Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic" (Izydorczak, Antoniuk, i in., 2022) przedstawia podłużne badanie, eksplorujące zmiany nierealistycznego optymizmu podczas pierwszego roku pandemii COVID-19. Nierealistyczny optymizm badany był w odniesieniu do oceny ryzyka zakażenia COVID-19 (u siebie samego oraz u rówieśników tej samej płci i wieku). Badanie obejmowało 16 pomiarów nierealistycznego optymizmu, zrealizowanych na próbie 120 polskich pracowników międzynarodowej firmy telekomunikacyjnej.

W przeciwieństwie do badań przedstawionych w pozostałych artykułach, zbieranie danych nie było poprzedzone analizą mocy testu czy też postawieniem konkretnych hipotez. To przykład badania, które rozpoczęte zostało w odpowiedzi na nagłą, zmieniającą się sytuację społeczną – początek światowej pandemii. W momencie rozpoczęcia badania nie było jeszcze stwierdzonego

ani jednego przypadku zachorowania na COVID-19 w Polsce, a przewidywania dotyczące zasięgu, skutków i czasu trwania pandemii były jedynie spekulacjami. Konkretne hipotezy zostały jednak postawione po zebraniu danych i dotyczyły one związków pomiędzy zmianami w nasileniu nierealistycznego optymizmu a rozmaitymi zmianami środowiska w czasie. Postawione hipotezy koncentrowały się przede wszystkim na testowaniu poznawczych oraz motywacyjnych korzeni zjawiska nierealistycznego optymizmu.

Ostatecznie, artykuł powstały na bazie zebranych danych poruszał trzy problemy badawcze: 1) Występowanie oraz zmiany nierealistycznego optymizmu w czasie, 2) Związek pomiędzy poziomem nierealistycznego optymizmu a wskaźnikami zachorowań oraz śmierci w wyniku COVID-19, 3) Związek pomiędzy nasileniem nierealistycznego optymizmu a zmieniającymi się rządowymi obostrzeniami związanymi z pandemią, 4) Związek pomiędzy nasileniem nierealistycznego optymizmu a zmieniającą się mobilnością mieszkańców w przestrzeni publicznej. Analizy statystyczne opierały się z jednej strony na dokonanych wśród respondentów pomiarach dotyczących nierealistycznego optymizmu, a z drugiej strony na zastanych danych, dostępnych w publicznych zasobach. Były to kolejno: statystyki zachorowań i śmierci w wyniku COVID-19, kalendarium rządowych regulacji, zaleceń i komunikatów związanych z pandemią, oraz dane Google Mobility Trends – dane użytkowników telefonów komórkowych, dotyczące ich geograficznej lokalizacji.

W badaniu tym udało się przede wszystkim wykazać, że nierealistyczny optymizm w związku z zakażeniem COVID-19 pojawił się wśród respondentów dopiero po ujawnieniu pierwszego przypadku COVID-19 w Polsce, a następnie utrzymywał się (chociaż na zmiennym poziomie) przez cały pierwszy rok trwania pandemii (patrz: Fig. 4, Artykuł 2). Okazało się także, że poziom przejawianego nierealistycznego optymizmu wiązał się z wskaźnikami zachorowań i śmierci – im były one wyższe, tym wzrastał poziom nierealistycznego optymizmu (mierzony jako różnica w oszacowaniu ryzyka zachorowania dla siebie oraz dla innych). Siła korelacji była jednak minimalna,

a wizualna analiza relacji pomiędzy zmiennymi wskazywała na nieregularny i krzywoliniowy związek. Zmiany w częstotliwości wychodzenia z domu i co za tym idzie bezpośredniej obserwacji zachowań innych ludzi, również nie okazały się być adekwatnym predyktorem zmian w nierealistycznym optymizmie. Wynik *Residence Mobility* dla obszaru zamieszkania respondentów nie wiązał się w sposób istotny z poziomem przejawianego przez nich nierealistycznego optymizmu.

Spośród uwzględnianych zjawisk, jedynie zmiany w obrębie pandemicznych obostrzeń okazały się w sposób istotny wiązać z poziomem nierealistycznego optymizmu. Okazało się, że w okresach zaostrzania pandemicznych regulacji (przykładowo – zamykania galerii handlowych, czy zakazów rekreacyjnego przemieszczania się), nierealistyczny optymizm nasilał się.

Przeprowadzane badanie było w momencie opublikowania najdłuższym badaniem podłużnym, dotyczącym nierealistycznego optymizmu oraz jednym z pierwszych, w którym nierealistyczny optymizm badany był w odniesieniu do długotrwałego, zewnętrznego zagrożenia. Wyniki badania wyraźnie sugerują, że nierealistyczny optymizm jest w takich okolicznościach ściśle związany z poziomem odczuwanego zagrożenia – pojawił się on dopiero wtedy, kiedy zagrożenie stało się bezpośrednie (pierwsze zakażenie w Polsce), nasilał się wtedy, gdy z otoczenia płynęły jasne sygnały o wzroście zagrożenia (wprowadzanie obostrzeń), osłabiał zaś wtedy, gdy sygnały były przeciwne (luzowanie obostrzeń).

Słaby związek nierealistycznego optymizmu z obiektywnymi wskaźnikami zagrożenia (statystykami) świadczyć może o relatywnej naturze przetwarzania przez ludzi informacji o liczbach (informacje o pierwszych zakażeniach mogą wywoływać zupełnie inne reakcje niż o kolejnych setkach). Innym wyjaśnieniem może być teza, że informacje o charakterze abstrakcyjnym stanowią mniej czytelny sygnał zagrożenia, niż konkretne, wpływające na nasze życie decyzje podejmowane przez władze.

Brak związku pomiędzy nierealistycznym optymizmem a poziomem fizycznej izolacji świadczy natomiast na niekorzyść czysto poznawczego wyjaśnienia nierealistycznego optymizmu. Wyjaśnienie to zakłada, że nierealistyczny optymizm bierze się z mniejszej dostępności informacji o zachowaniach innych ludzi. Zgodnie z nim powinien nasilać się więc w okresie izolacji, gdy nasze szanse na obserwacje zachowań innych są jeszcze mniejsze niż zwykle. Tak się jednak nie działo.

Wyniki badania są za to zgodne z motywacyjno-emocjonalnym wyjaśnieniem nierealistycznego optymizmu. W tym ujęciu nierealistyczny optymizm to obronna reakcja na stan zagrożenia, która pomaga nam utrzymać dobrostan psychiczny i podtrzymać motywację do działań. Zgodnie z tym wyjaśnieniem, powinien on nasilać się wtedy, gdy odczuwane zagrożenie wzrasta. Taką właśnie zależność sugerują wyniki naszego badania.

Artykuł 3: Do Unbiased People Act More Rationally?—The Case of Comparative Realism and Vaccine Intention

Trzeci artykuł - „Do unbiased people act more rationally?—The case of comparative realism and vaccine intention" (Izydorczak i in., 2023) prezentuje serię trzech badań, z których każde porusza temat związku pomiędzy nierealistycznym optymizmem a intencją zaszczepienia się przeciwko COVID-19. Na serię składa się mini-metaanaliza sześciu badań (zob. opis tej metody w Goh i in., 2016), zrealizowanych wcześniej przez członków naszego zespołu oraz dwa pre-rejestrowane badania własne, których celem była replikacja oraz wyjaśnienie wyników uzyskanych w mini-metaanalizie.

Wstępem do mini-metaanalizy było sprawdzenie rozkładu zmiennej „nierealistyczny optymizm" w sześciu udostępnionych mi bazach danych. Okazało się, że w rozkładzie tej zmiennej występuje zjawisko analogiczne do opisanego w Artykule 1 – punktowa inflacja (por. *Figure 4*, Izydorczak, Grzyb, i in., 2022 z *Figure 1,* Izydorczak i in., 2023). Podobnie jak w przypadku dehumanizacji, tutaj także wyraźnie nad-reprezentowane były wyniki świadczące o braku tendencyjności w ocenach. Wynik „0", oznaczający, że osoba badana ocenia ryzyko zakażenia wirusem SARS-CoV-2 dla siebie i innych jako identyczne, występował w aż 33% obserwacji. Znaczy to, że poza tradycyjnie opisywanymi w literaturze

„nierealistycznymi pesymistami" (osobami przekonanymi, że sprawy przybierają gorszy obrót dla nich niż dla innych – zob. Dolinski i in., 1987) oraz „nierealistycznymi optymistami", mamy do czynienia ze sporą grupą osób, których funkcjonowanie niemal nigdy nie bywa przez badaczy analizowane (zob. Bortolotti i Antrobus, 2015 - jeden nielicznych wyjątków od tej reguły).

Postanowiliśmy uzupełnić te lukę, odchodząc od badania nierealistycznego optymizmu w stronę badania porównawczych ocen ryzyka, w ramach których nierealistyczny optymizm (w naszym ujęciu „porównawczy optymizm") jest tylko jedną z trzech możliwych tendencji. Pozostałymi dwoma są porównawczy pesymizm i porównawczy realizm. Ten ostatni, jako najciekawszy i najsłabiej zbadany, uczyniliśmy głównym punktem skupienia.

W mini-metaanalizie chcieliśmy przekonać się, czy osoby prezentujące poznawczy realizm, poznawczy optymizm oraz poznawczy pesymizm względem zarażenia SARS-CoV-2, różnią się intencją zaszczepienia przeciwko COVID-19. Tradycyjnie, nierealistyczny optymizm ujmowany jest w psychologii zdrowia jako zagrożenie dla pro-zdrowotnych zachowań (zob. Dillard i in., 2009). Zarówno teoretyczne jak i empiryczne przesłanki skłaniają badaczy do traktowania go jako jednej z barier w konstruktywnym radzeniu sobie. Skoro zakrzywiając obraz rzeczywistości zyskujemy fałszywe pokrzepienie, oddali nas to od szukania realnych rozwiązań. Przypuszczaliśmy zatem, że porównawczy optymiści będą mniej chętni do szczepień. Natrafiliśmy jednak na odwrotne zjawisko.

Mini-metaanaliza wskazała, że spośród trzech kategorii porównawczych, to porównawczy realiści cechowali się najniższą intencją zaszczepienia. Porównawczy optymiści i pesymiście mieli wyższą intencję zaszczepienia i nie różnili się istotnie między sobą. Okazało się, że wyniku tego nie da się wytłumaczyć absolutnymi wartościami szacunków ryzyka (realiści nie szacują ryzyka zarażenia jako mniejszego) ani też niedbałością w wypełnianiu ankiety (realiści nie wypełniają jej szybciej niż pozostali). Ten zaskakujący rezultat wymagał replikacji oraz wyjaśnienia. To właśnie stało się celem dwóch kolejnych badań.

W pierwszym badaniu sprawdzaliśmy przypuszczenie, że różnica pomiędzy realistami a optymistami w zakresie intencji zaszczepienia bierze się z różnicy w przekonaniu o sprawowanej przez przez nich psychologicznej kontroli (skala *Locus of control* - Sapp & Harrod, 1993) oraz w stopniu dążenia do jej sprawowania (skala *desirability for control* - Burger & Cooper, 1979). Zakładaliśmy, że wysoki poziom wewnętrznej kontroli oraz dążenie do jej sprawowania będzie wiązało się zarówno z byciem porównawczym optymistą („jestem u sterów, więc lepiej ochronie się przed zarażeniem") jak i z intencją zaszczepienia („zaszczepię się, bo chcę i mogę uzyskać większa kontrolę nad własnym zdrowiem").

W badaniu zreplikowane zostały rezultaty mini-metaanalizy – jeszcze raz okazało się, że porównawczy realiści mają niższą intencją zaszczepienia od porównawczych optymistów. Nasze hipotezy nie zyskały jednak potwierdzenia. Nie znaleźliśmy dowodów na związki pomiędzy porównawczym realizmem a psychologiczną kontrolą. Co więcej – mierzone skale psychologicznej kontroli nie wiązały się istotnie z intencją zaszczepienia. Jedynie jedna z pod-skal *Locus of control - powerful others*, okazała się korelować negatywnie z intencją zaszczepienia. Związek ten był jednak bardzo słaby. Warto przy tym dodać, że osiągnięta w badaniu wysoka moc testów statystycznych praktycznie wykluczała możliwość przypadkowego pominięcia silnych lub umiarkowanych związków.

Skoro związek pomiędzy porównawczym realizmem a niższą intencją zaszczepienia nie może być wyjaśniony przez pryzmat różnic w mechanizmach kontroli psychologicznej, należało przetestować inne wyjaśnienia. W ostatnim badaniu z serii postawiliśmy hipotezę, iż realiści i optymiści będą odmiennie oceniać stosunek szans i zagrożeń, płynących ze szczepień przeciwko COVID-19. Sądziliśmy, że zarówno porównawczy realizm jak i wahanie się względem szczepień stanowić będą wyraz decyzyjnego impasu - stanu, w którym jednostka nie jest pewna, czy bardziej powinna bać się choroby czy też lekarstwa (w tym wypadku – szczepionki). Brak porównawczego optymizmu (lub pesymizmu) oznacza w tym ujęciu stan zawieszenia – zastój psychicznych reakcji obronnych.

W badaniu po raz kolejny potwierdziliśmy główny wynik – realiści cechowali się najniższą intencją zaszczepienia. Potwierdziliśmy także nasze hipotezy. Po pierwsze u realistów proporcja obaw odnośnie choroby i szczepionki przeciwko COVID-19 była bardziej wyrównana a porównawczych optymistów bardziej przesunięta w stronę obawy przed chorobą. Po drugie zaś różnica w obawach odnośnie choroby i szczepionki okazała się silnie korelować z intencją zaszczepienia.

Seria badań przedstawionych w Artykule nr 3 stanowi według naszej wiedzy jedyny opublikowany w literaturze światowej program badawczy skoncentrowany na psychologicznym funkcjonowaniu porównawczych realistów. Dyskusyjnym pozostaje, na ile odkryte w ramach tej serii badań prawidłowości nie są ograniczone do specyficznego kontekstu pandemii. Jednak nawet jeśli tak jest, to stanowią one dowód na istotny wyjątek od narracji dominujące w literaturze – nierealistyczny optymizm wiąże się bowiem w naszej serii badań z konstruktywnym działaniem prozdrowotnym (intencją zaszczepienia). Brak tendencyjności w ocenie zagrożenia świadczy zaś raczej o braku zaangażowania w radzenie sobie, które wynikać może ze zbyt intensywnego i uważnego przetwarzania informacji (zwłaszcza tych o zagrożeniu).

Artykuł 4: Vaccine Skeptics and Vaccine Enthusiasts: What is the Intergroup Wall Made of?

Czwarty artykuł z serii - „*Vaccine skeptics and vaccine enthusiasts: What is the intergroup wall made of?*" (Izydorczak i Doliński, 2023) złożony został do publikacji do czasopiśmie *Collabra: Psychology* w formacie „Registered Reports" (zob. Chambers & Tzavella, 2021). Format ten oznacza, że pre-rejestracja badania oraz wstęp i rozdział metodologiczny zostały poddane recenzji przed zbieraniem danych. Po rundzie rewizji, zostały one zatwierdzone, a czasopismo przyznało artykułowi status „in-principle acceptance". Status ten oznacza, że jeśli badanie zostanie wykonane zgodnie z planem, artykuł je opisujący zostanie przyjęty do druku z niezmienionym wstępem oraz sekcją metod. W ramach niniejszej rozprawy doktorskiej, prezentuje całościowy tekst po zebraniu danych, który przed złożeniem dysertacji przesłany został do redakcji *Collabra: Psychology*.

Artykuł prezentuje jedno badanie przeprowadzone równolegle na trzech niezależnych próbach – mieszkańcach Polski, RPA oraz Stanów Zjednoczonych. Celem badania było sprawdzenie, czy osoby deklarujące się jako przeciwnicy oraz zwolennicy szczepionek przeciwko COVID-19 dehumanizują się wzajemnie. Przy projektowaniu badania oraz formułowaniu hipotez wzięto pod uwagę literaturę na temat narracji, którą grupy anty- i pro-szczepionkowców opisują się wzajemnie oraz na temat tego, jak obie grupy motywują swoje stanowiska (zob. Chu i in., 2021; Cuesta-Cambra i in., 2019; Maciuszek i in., 2021). Literatura ta potwierdza intuicyjne przekonanie, że grupy te postrzegają się negatywnie, wzbogacając jednak ten obraz o szczegółowe informacje na temat specyficznej treściowej zawartości wzajemnych uprzedzeń.

Celem badania było sprawdzenie, czy wzajemnej nieufności lub wręcz wrogości towarzyszyć będzie także dehumanizacja oraz, czy specyficzne dla każdej z grup narracje o niej samej i o grupie przeciwnej, przełożą się na odmienne rodzaje dehumanizacji. Dodatkowym celem było zbadanie stopnia uniwersalności wzajemnych postaw pro- i anty-szczepionkowców. W tym celu zrekrutowaliśmy próby z trzech krajów o odmiennych uwarunkowaniach ekonomicznych, kulturowych oraz społecznych, dodatkowo oddalonych od siebie geograficznie. W badaniu uwzględniliśmy także trzy różne miary dehumanizacji (*dwu-czynnikową dehumanizację* - Haslam, 2006, *jawną dehumanizację* - Kteily i in., 2015, oraz metodę *human/animal- related words* - Viki i in., 2006), miarę uprzedzeń (*termometr uczuć*) oraz miarę intensywności kontaktu wewnątrz- i międzygrupowego (pytania o intensywność kontaktu online i offline z osobami o przeciwnych i zgodnych poglądach na szczepienia).

Przewidywaliśmy, że pro-szczepionkowcy będą dehumanizować anty-szczepionkowców w wymiarach jawnym i animalistycznym, anty-szczepionkowcy zaś dehumanizować będą pro-szczepionkowców w wymiarze mechanistycznym. Ponadto spodziewaliśmy się, że anty-szczepionkowcy doświadczać będą meta-dehumanizacji – będą przekonani o tym, że są dehumanizowani przez pro-szczepionkowców (zob. Kteily & Bruneau, 2017). To przekonanie będzie tym mocniejsze, im częstszy będzie kontakt anty-szczepionkowców z pro-szczepionkowcami.

Badanie potwierdziło nasze generalne założenie, że postawy wobec szczepień przeciwko COVID-19 stanowią dostateczną siłę grupo-twórczą. Na bazie tych postaw może wytworzyć się preferencja grupy własnej, de-faworyzacja grupa obcej oraz tendencja do unikania z nią kontaktu. Znaleźliśmy dowody zarówno na wzajemną niechęć, jak i na zjawisko „kabiny pogłosowej" (*echo chamber)* – przedstawiciele obu grup kontaktowali się częściej z osobami o zgodnych, niż przeciwnych poglądach, zarówno w formie online i offline.

Nasze przewidywania odnośnie form wzajemnej dehumanizacji potwierdziły się częściowo. O ile pro-szczepionkowcy faktycznie dehumanizowali anty-szczepionkowców w jawnej oraz animalistycznej formie, o tyle anty-szczepionkowcy nie dehumanizowali pro-szczepionkowców mechanistycznie. Potwierdziła się także hipoteza o doświadczaniu przez anty-szczepionkowców meta-dehamanizacji, jednak nie okazała się ona zależna od stopnia kontaktów z przeciwną grupą.

Podsumowując wyniki należy stwierdzić, że wzajemna dehumanizacja obu grup jest po pierwsze silna, po drugie uniwersalna (brak istotnych różnic między krajami), po trzecie zaś mało specyficzna. Zamiast zróżnicowanych i subtelnych form dehumanizacji, zmieniających się w zależności od tego jakiej grupy dotyczą, napotkaliśmy silną i mocno symetryczną dehumanizację, która przejawiała się przede wszystkim w jej najbardziej bezpośrednich formach. Pro- i anty-szczepionkowcy w niewielkim stopniu odmawiali sobie nawzajem elementów ludzkie natury (*mechanizacja*) czy ludzkiej unikatowości (*animalizacja*), częściej zaś kojarzyli grupę obcą z istotami o dosłownie niepełnym stopniu człowieczeństwa (*jawna dehumanizacja*, metoda *animal/human- related words*). Chociaż zjawisko to było silne z obu stron, w większym stopniu przejawiali je pro-szczepionkowcy. Silna i obustronna była także meta-dehumanizacja – badani byli przekonani, że druga strona dehumanizuje ich we wszystkich badanych formach.

Taki wzorzec wyników (niski poziom subtelnej dehumanizacji, wysoki poziom dehumanizacji bezpośredniej i meta-dehumanizacji) był do tej pory odkrywany w odniesieniu do relacji pomiędzy grupami większościowymi a najbardziej dyskryminowanymi mniejszościami, bądź też pomiędzy grupami

będącymi w jawnym, fizycznym i symbolicznym konflikcie (por. Bruneau & Kteily, 2017). Dość powiedzieć, że siła uprzedzeń (mierzonych *termometrem uczuć*) oraz nasilenie *jawnej dehumanizacji* pomiędzy pro- i anty-szczepionkowcami było porównywalne z postawami Polaków wobec Romów, którzy stanowią najgorzej odbieraną w Polsce mniejszość etniczną (por. *„Table 4",* Izydorczak, Grzyb, i in., 2022).

Prezentowane badanie jest według naszej wiedzy pierwszym eksplorującym temat dehumanizacji ze względu na postawę wobec szczepień i prezentuje ważne, choć niepokojące i pesymistyczne wnioski. W świetle tych wniosków łatwiej jest jednak zrozumieć liczne porażki w próbach wypracowania skutecznych sposobów zmiany postaw wobec szczepień (zob. Sadaf i in., 2013). Ten typ oddziaływania może być bowiem traktowany jak komunikacja ze strony wrogiej nam grupy, która dodatkowo ma on o „nas" jak najgorsze zdanie a celem tej komunikacji jest przemiana „nas" w „nich".

Podsumowanie i dyskusja wyników

Przedłożona seria artykułów prezentuje badania ukazujące indywidualne (porównawczy optymizm) oraz grupowe (dehumanizacja) procesy porównań psychologicznych, które stały się udziałem ludzi podczas trwania pandemii COVID-19. Z jednej strony wyniki badań ukazują, w jaki sposób korzystne porównania „ja" - „inni" mogą sprzyjać procesowi radzenia sobie z sytuacją. Okazało się, że ocenianie szansy na zakażenia SARS-CoV-2 jako niższej niż u innych ludzi, przynosić może nie tylko emocjonalny komfort, ale też współwystępować z konstruktywnymi strategiami postępowania (chęcią zaszczepienia się).

Z drugiej zaś strony, korzystne porównania „my" - „oni" wśród zwolenników i przeciwników szczepionek, osiągnęły poziom na tyle intensywny, że stał się on analogiczny do napięć między-etnicznych. Być może podział ów ma ten pozytywny skutek, że czyni postawę zwolenników szczepień mniej podatną na anty-szczepionkowy przekaz, z drugiej strony zaś niewątpliwie utrudnia zmianę postaw osób sceptycznych wobec szczepień. Po pierwsze, osoba negatywnie nastawiona do szczepionek może odbierać pro-szczepionkowy przekaz jako komunikat kierowany przez wrogą, obcą grupę. Po drugie zaś

zwolennicy szczepionek mogą mieć trudności z formułowaniem przekazu, który nie będzie obciążony ich własnymi negatywnymi stereotypami i uproszczeniami na temat grupy docelowych odbiorców.

Poza wnioskami dotyczącymi sądów porównawczych w obliczu pandemii COVID-19, przedstawiona seria prac stanowi cenny wkład w budowę teorii porównawczego optymizmu oraz dehumanizacji. W temacie porównawczego optymizmu, dostarcza wyraźnych dowodów na rzecz motywacyjnych przyczyn jego powstawania a także wskazuje na dotychczas niedostatecznie eksplorowany wątek jakościowych różnic pomiędzy osobami przejawiającymi porównawczy optymizm i porównawczy realizm. Postać tych różnic okazała się zaskakująca – to właśnie osoby przejawiające porównawczy realizm cechowały się wyższą intencją zaszczepienia. Znaczenie tego wyniku trudno jest ocenić bez dalszych badań. W wariancie minimum wskazuje on na to, że nierealistyczny optymizm nie musi stać w sprzeczności z konstruktywnym radzeniem sobie z wyzwaniami środowiska i warto poszukiwać w badaniach czynników, w których ów wyjątek od reguły może mieć zastosowanie. W literaturze znaleźć można odniesienia do innych sytuacji, w których nierealistyczny optymizm zdaje się mieć pozytywne skutki. Dotyczą one długotrwałych, niekontrolowanych okoliczności, takich jak bycie zarażonym wirusem HIV czy też bycie w grupie ryzyka chorób układu krążenia – zob. Shepperd i in., 2015.

W wariancie maksimum, wynik ten może oznaczać, że dominujący dotychczas w literaturze obraz nierealistycznego optymizmu jako inhibitora konstruktywnych działań może być nietrafny. Brać on się może bądź to ze stronniczości publikacyjnej (*publication bias* - zob. Ferguson & Heene, 2012), bądź z nieuwzględniania w analizach porównania z osobami, które cechowały się porównawczym realizmem. Możliwym jest bowiem, że wewnątrz kategorii „nierealistyczni optymiści", im większy poziom tegoż optymizmu, tym mniejsze zaangażowanie w prozdrowotne działania. Jednocześnie jednak „nierealistyczni optymiści" jako kategoria mogą być bardziej skłonni do prozdrowotnych działań niż osoby zupełnie pozbawione tej tendencji.

Rozważanie takie wpisują się w kluczową dyskusję o roli i rozumieniu racjonalności w badaniach psychologicznych czy ekonomicznych. W dyskusji tej z jednej strony traktuje się odstępstwa od modelowej racjonalności (*cognitive biases*) jako ubytki ludzkiego systemu poznawczego, którym warto przeciwdziałać (zob.: Lilienfeld i in., 2009) z drugiej zaś strony jako optymalne strategie funkcjonowania, realizujące inne i ważniejsze cele, niż maksymalizacja matematycznej poprawność (zob. Gigerenzer & Todd, 1999)

W odniesieniu do dehumanizacji, prezentowane przeze mnie badania wpisują się w bardzo obecnie żywą dyskusję nad teoretycznym znaczeniem konstruktu (czy raczej konstruktów) dehumanizacji oraz sposobami jego pomiaru (zob. Over, 2021; Vaes i in., 2021). Wyniki badań przedstawione w pierwszym artykule serii (Izydorczak, Grzyb, i in., 2022) oddalają co prawda pewne metodologicznie i etyczne zarzuty podnoszone wobec narzędzia *Ascent of humans*, sygnalizują jednak problemy, które wciąż nie są w pełni zażegnane. Wyniki przedstawione zarówno w artykule 1 jak i artykule 4 wskazują na nikły związek subtelnych i bezpośrednich form dehumanizacji ze sobą nawzajem, za to na bardzo bliski związek bezpośrednich form dehumanizacji z niechęcią wobec grupy obcej. Podnoszony zatem argument, że dehumanizacja jest w istocie niczym więcej niż formą de-faworyzacji grupy obcej czy też niechęcią do niej, ubraną w pewną metaforę (zob. Enock, Flavell, i in., 2021; Enock, Tipper, i in., 2021) zyskuje poparcie w przedstawionych przeze mnie badaniach.

Wątki badań nad dehumanizacją i porównawczym optymizmem spotykają się w kontekście pomiaru. W przypadku obu tych porównawczych sądów, prezentowane przeze mnie badania wskazują na do tej pory niedostatecznie omawiane zjawisko – wysoki odsetek osób, które nie różnicują w pomiarach grupy obcej i własnej (lub „innych" i „siebie"). Zjawisko to ma dwojakie konsekwencje. Z jednej strony podważa prawidłowość powszechnie stosowanych obliczeń statystycznych opartych na średniej. Z drugiej strony skłania do odmiennego rozumienia badanych zmiennych, sugerując, że to różnica pomiędzy „stronniczymi" a „niestronniczymi" jest kluczowa

psychologicznie i koncentrując uwagę właśnie na niej, poznamy najlepiej przyczyny i konsekwencje badanych zjawisk.

Od strony czysto statystycznej, wyniki przedłożonych badań sugerują, że powszechnie używane obliczenia bazujące na średniej mogą dawać błędne rezultaty – średnia bowiem (lub nawet średnia rang) przestaje być adekwatną miarą, gdy pomiędzy punktami skali zachodzi jakościowa a nie tylko ilościowa różnica. W takich sytuacjach, lepszym wyborem jest bądź to zastosowanie analiz z uwzględnianiem punktów odcięcia (*hurdle models*) bądź też inflacji punktowej (*zero-inflated models*) (Hu i in., 2011). Inną alternatywą (zastosowaną w przedstawionej serii pracy) jest potraktowanie badanych zmiennych jako kategorialnych.

Przedstawiona seria artykułów łączy badania nad konstruktami o osobnych tradycjach, które jednak posiadają wiele punktów stycznych. Analizowanie ich we wspólnym kontekście pandemii COVID-19, pozwala na uchwycenie wielu aspektów tego samego psychologicznego problemu – odnajdowania się jednostek w sytuacji poważnego, nieznanego, uniwersalnego i przedłużającego się zagrożenia. Ukazuje przy tym procesy przetwarzania informacji o zagrożeniu, wyboru ścieżki rozwiązania problemu oraz tworzenia postaw międzygrupowych. Dzięki połączeniu w jednym programie badawczym rzadko zestawianych konstruktów, ukazany obraz jest bardziej kompletny a wspólne dla owych konstruktów metodologiczne, teoretyczne i psychometryczne wyzwania mogły zostać najpierw naświetlone, a następnie rozstrzygnięte przy pomocy analogicznych rozwiązań.

Bibliografia

Bortolotti, L., & Antrobus, M. (2015). Costs and benefits of realism and optimism. *Current Opinion in Psychiatry*, *28*(2), 194–198. https://doi.org/10.1097/YCO.0000000000000143

Bruneau, E., & Kteily, N. (2017). The enemy as animal: symmetric dehumanization during asymmetric warfare. *PLOS ONE*, *12*(7), e0181422–e0181422. https://doi.org/10.1371/journal.pone.0181422

Burger, J. M., & Cooper, H. M. (1979). The desirability of control. *Motivation and Emotion*, *3*(4), 381–393. https://doi.org/10.1007/BF00994052

Chambers, C. D., & Tzavella, L. (2021). The past, present and future of Registered Reports. *Nature Human Behaviour*, *6*(1), 29–42. https://doi.org/10.1038/s41562-021-01193-7

Chu, H., Yuan, S., & Liu, S. (2021). Call them COVIDiots: Exploring the effects of aggressive communication style and psychological distance in the communication of COVID-19. *Public Understanding of Science*, *30*(3), 240–257. https://doi.org/10.1177/0963662521989191

Clarke, V. A., Lovegrove, H., Williams, A., & Machperson, M. (2000). Unrealistic Optimism and the health belief model. *Journal of Behavioral Medicine*, *23*(4), 367–376. https://doi.org/10.1023/A:1005500917875

Cuesta-Cambra, U., Martínez-Martínez, L., & Niño-González, J.-I. (2019). An analysis of pro-vaccine and anti-vaccine information on social networks and the internet: Visual and emotional patterns. *Profesional de La Información*, *28*(2), Article 2. https://doi.org/10.3145/epi.2019.mar.17

Dillard, A. J., Midboe, A. M., & Klein, W. M. P. (2009). The dark side of optimism: unrealistic optimism about problems with alcohol predicts subsequent negative event experiences. *Personality and Social Psychology Bulletin*, *35*(11), 1540–1550. https://doi.org/10.1177/0146167209343124

Dolinski, D., Gromski, W., & Zawisza, E. (1987). Unrealistic pessimism. *The Journal of Social Psychology*, *127*(5), 511–516. https://doi.org/10.1080/00224545.1987.9713735

Enock, F. E., Flavell, J. C., Tipper, S. P., & Over, H. (2021). No convincing evidence outgroups are denied uniquely human characteristics: distinguishing intergroup preference from trait-based dehumanization. *Cognition*, *212*, 104682. https://doi.org/10.1016/j.cognition.2021.104682

Enock, F. E., Tipper, S. P., & Over, H. (2021). Intergroup preference, not dehumanization, explains social biases in emotion attribution. *Cognition*, *216*, 104865. https://doi.org/10.1016/j.cognition.2021.104865

Ferguson, C. J., & Heene, M. (2012). A vast graveyard of undead theories: publication bias and psychological science's aversion to the null. *Perspectives on Psychological Science*, *7*(6), 555–561. https://doi.org/10.1177/1745691612459059

Gigerenzer, G., & Todd, P. M. (1999). *Simple heuristics that make us smart.* (s. xv, 416). Oxford University Press.

Goh, J. X., Hall, J. A., & Rosenthal, R. (2016). Mini Meta-Analysis of Your Own Studies: Some Arguments on Why and a Primer on How: Mini Meta-Analysis. *Social and Personality Psychology Compass*, *10*(10), 535–549. https://doi.org/10.1111/spc3.12267

Green, J. A. (2021). Too many zeros and/or highly skewed? A tutorial on modelling health behaviour as count data with Poisson and negative binomial regression. *Health Psychology and Behavioral Medicine*, *9*(1), 436–455. https://doi.org/10.1080/21642850.2021.1920416

Haslam, N. (2006). Dehumanization: an integrative review. *Personality and Social Psychology Review*, *10*(3), 252–264. https://doi.org/10.1207/s15327957pspr1003_4

Haslam, N., & Stratemeyer, M. (2016). Recent research on dehumanization. *Current Opinion in Psychology*, *11*, 25–29. https://doi.org/10.1016/j.copsyc.2016.03.009

Hu, M.-C., Pavlicova, M., & Nunes, E. V. (2011). Zero-inflated and hurdle models of count data with extra zeros: examples from an HIV-risk reduction intervention trial. *The American Journal of Drug and Alcohol Abuse*, *37*(5), 367–375. https://doi.org/10.3109/00952990.2011.597280

Izydorczak, K., Antoniuk, K., Kulesza, W., Muniak, P., & Dolinski, D. (2022). Temporal aspects of unrealistic optimism and robustness of this bias: a longitudinal study in the context of the COVID-19 pandemic. *PLOS ONE*, *17*(12), e0278045. https://doi.org/10.1371/journal.pone.0278045

Izydorczak, K., Dolinski, D., Genschow, O., Kulesza, W., Muniak, P., Casara, B. G. S., & Suitner, C. (2023). Do unbiased people act more rationally?—the case of comparative realism and vaccine intention. *Royal Society Open Science*, *10*(2), 220775. https://doi.org/10.1098/rsos.220775

Izydorczak, K., Grzyb, T., & Dolinski, D. (2022). Ascent of humans: investigating methodological and ethical concerns about the measurement. *Collabra: Psychology*, *8*(1), 33297. https://doi.org/10.1525/collabra.33297

Kteily, N., & Bruneau, E. (2017). Backlash: the politics and real-world consequences of minority group dehumanization. *Personality and Social Psychology Bulletin*, *43*(1), 87–104. https://doi.org/10.1177/0146167216675334

Kteily, N., Bruneau, E., Waytz, A., & Cotterill, S. (2015). The ascent of man: theoretical and empirical evidence for blatant dehumanization. *Journal of Personality and Social Psychology*, *109*(5), 901–931. pdh. https://doi.org/10.1037/pspp0000048

Leyens, J.-P., Paladino, P. M., Rodriguez-Torres, R., Vaes, J., Demoulin, S., Rodriguez-Perez, A., & Gaunt, R. (2000). The emotional side of prejudice: the attribution of secondary emotions to ingroups and outgroups. *Personality and Social Psychology Review*, *4*(2), 186–197. https://doi.org/10.1207/S15327957PSPR0402_06

Lilienfeld, S. O., Ammirati, R., & Landfield, K. (2009). Giving debiasing away: can psychological research on correcting cognitive errors promote human welfare? *Perspectives on Psychological Science*, *4*(4), 390–398. https://doi.org/10.1111/j.1745-6924.2009.01144.x

Maciuszek, J., Polak, M., Stasiuk, K., & Doliński, D. (2021). Active pro-vaccine and anti-vaccine groups: Their group identities and attitudes toward science. *PLOS ONE*, *16*(12), e0261648. https://doi.org/10.1371/journal.pone.0261648

Over, H. (2021). Seven challenges for the dehumanization hypothesis. *Perspectives on Psychological Science*, *16*(1), 3–13. https://doi.org/10.1177/1745691620902133

Sadaf, A., Richards, J. L., Glanz, J., Salmon, D. A., & Omer, S. B. (2013). A systematic review of interventions for reducing parental vaccine refusal and vaccine hesitancy. *Vaccine*, *31*(40), 4293–4304. https://doi.org/10.1016/j.vaccine.2013.07.013

Sapp, S. G., & Harrod, W. J. (1993). Reliability and validity of a brief version of Levenson's locus of control scale. *Psychological Reports*, *72*(2), 539–550. https://doi.org/10.2466/pr0.1993.72.2.539

Shepperd, J. A., Waters, E., Weinstein, N. D., & Klein, W. M. P. (2015). A Primer on unrealistic optimism. *Current directions in psychological science*, *24*(3), 232–237. https://doi.org/10.1177/0963721414568341

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, *5*(2), 207–232. https://doi.org/10.1016/0010-0285(73)90033-9

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: heuristics and biases. *Science*, *185*(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Vaes, J., Paladino, M. P., & Haslam, N. (2021). Seven clarifications on the psychology of dehumanization. *Perspectives on Psychological Science*, *16*(1), 28–32. https://doi.org/10.1177/1745691620953767

Viki, G. T., Winchester, L., Titshall, L., Chisango, T., Pina, A., & Russell, R. (2006). Beyond secondary emotions: The infrahumanization of outgroups using human–related and animal–related words. *Social Cognition*, *24*(6), 753–775. https://doi.org/10.1521/soco.2006.24.6.753

Weinstein, N. D. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology*, *39*(5), 806–820. https://doi.org/10.1037/0022-3514.39.5.806

Spis prac naukowych wchodzących w skład rozprawy

Artykuł 1:

Izydorczak, K., Grzyb, T., & Dolinski, D. (2022). Ascent of Humans: Investigating methodological and ethical concerns about the measurement. *Collabra: Psychology*, *8*(1). https://doi.org/10.1525/collabra.33297

Artykuł 2:

Izydorczak, K., Antoniuk, K., Kulesza, W., Muniak, P., & Dolinski, D. (2022). Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic. *PLOS ONE*, *17*(12), e0278045. https://doi.org/10.1371/journal.pone.0278045

Artykuł 3:

Izydorczak, K., Dolinski, D., Genschow, O., Kulesza, W., Muniak, P., Casara, B. G. S., & Suitner, C. (2023). Do unbiased people act more rationally?—The case of comparative realism and vaccine intention. *Royal Society Open Science*, *10*(2). https://doi.org/10.1098/rsos.220775

Artykuł 4:

Izydorczak, K., Dolinski, D. (under review). Vaccine skeptics and vaccine enthusiasts: What is the intergroup wall made of?. *Collabra: Psychology.*

Oświadczenia współautorów prac wchodzących w skład rozprawy

Oświadczenia współautorów publikacji nr. 1

The Co-Authorship Statement

Name of the candidate: Kamil Izydorczak

Publication: Izydorczak, K., Grzyb, T., & Dolinski, D. (2022). Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement. *Collabra: Psychology*, *8*(1), 33297

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: The candidate contributed to the conception of the study, participated in its design, and data collection. The candidate led the interpretation of the data, the statistical analysis, drafted the manuscript and led the revisions of the manuscript. The candidate's contribution is at least 50%.

The contribution of co-authors: The co-authors contributed to the conception of the study, data collection, interpretation of the data, and contributed to drafting and revising the manuscript.

Name: Kamil Izydorczak,

Institution: SWPS University of Social Sciences and Humanities

Email: kizydorczak@swps.edu.pl

Signature:

Name: Dariusz Doliński,

Institution: SWPS University of Social Sciences and Humanities

Email: ddolinsk@swps.edu.pl

Signature:

Name: Tomasz Grzyb,

Institution: SWPS University of Social Sciences and Humanities

Email: tgrzyb@swps.edu.pl

Signature:

Oświadczenia współautorów publikacji nr. 2

The Co-Authorship Statement

Name of the candidate: *Kamil Izydorczak*

Publication: *Izydorczak, K., Antoniuk, K., Kulesza, W., Muniak, P., & Dolinski, D. (2022). Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic. Plos one, 17(12), e0278045.*

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: *The candidate contributed to the conception of the study, participated in its design, and data collection. The candidate led the interpretation of the data, the statistical analysis, drafted the manuscript and led the revisions of the manuscript. The candidate's contribution is at least 50%.*

The contribution of co-authors: *The co-authors contributed to the conception of the study, data collection, interpretation of the data, and contributed to drafting and revising the manuscript.*

Name: Kamil Izydorczak,

Institution: SWPS University of Social Sciences and Humanities

Email: kizydorczak@swps.edu.pl

Signature:

Name: Karolina Antoniuk,

Institution: SWPS University of Social Sciences and Humanities

Email: kantoniuk1@st.swps.edu.pl

Signature:

Name: Wojciech Kulesza,

Institution: SWPS University of Social Sciences and Humanities

Email: wkulesza@swps.edu.pl

Signature:

Name: Paweł Muniak,

Institution: SWPS University of Social Sciences and Humanities

Email: pmuniak@swps.edu.pl

Signature:

Name: Dariusz Doliński,

Institution: SWPS University of Social Sciences and Humanities

Email: ddolinsk@swps.edu.pl

Signature:

Oświadczenia współautorów publikacji nr. 3

The Co-Authorship Statement

Name of the candidate: Kamil Izydorczak

Publication: Izydorczak, K., Dolinski, D., Genschow, O., Kulesza, W., Muniak, P., Casara, B. G. S., & Suitner, C. (2023). Do unbiased people act more rationally?—The case of comparative realism and vaccine intention. *Royal Society Open Science*, *10*(2), 220775.

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: The candidate contributed to the conception of the study, participated in its design, and data collection. The candidate led the interpretation of the data, the statistical analysis, drafted the manuscript and led the revisions of the manuscript. The candidate's contribution is at least 50%.

The contribution of co-authors: The co-authors contributed to the conception of the study, data collection, interpretation of the data, and contributed to drafting and revising the manuscript.

Name: Kamil Izydorczak,

Institution: SWPS University of Social Sciences and Humanities

Email: kizydorczak@swps.edu.pl

Signature:

Name: Dariusz Doliński,

Institution: SWPS University of Social Sciences and Humanities

Email: ddolinsk@swps.edu.pl

Signature:

Name: Oliver Genschow,

Institution: Leuphana University Lüneburg

Email: oliver.genschow@leuphana.de

Signature:

Name: Wojciech Kulesza,

Institution: SWPS University of Social Sciences and Humanities

Email: wkulesza@swps.edu.pl

Signature:

Name: Paweł Muniak,

Institution: SWPS University of Social Sciences and Humanities

Email: pmuniak@swps.edu.pl

Signature:

Name: Bruno Gabriel Salvador Casara

Institution: University of Padova

Email: brunogabriel.salvadorcasara@unipd.it

Signature:

Name: Caterina Suitner,

Institution: SWPS University of Social Sciences and Humanities

Email: caterina.suitner@unipd.it.

Signature:

Oświadczenia współautorów publikacji nr. 4

The Co-Authorship Statement

Name of the candidate: Kamil Izydorczak

Publication: Izydorczak, K., Dolinski, D, (under review). Vaccine-skeptics and vaccine-enthusiasts: What is the intergroup wall made of?. *Collabra: Psychology*

We, the undersigned, co-authors of the above publication, confirm that the above publication has not been submitted as evidence for which a degree or other qualification has already been awarded.

We, the undersigned, further indicate the candidate's contribution to the publication in our joint statement below.

Statement indicating the candidate's contribution to the publication: The candidate contributed to the conception of the study, participated in its design, and data collection. The candidate led the interpretation of the data, the statistical analysis, drafted the manuscript and led the revisions of the manuscript. The candidate's contribution is at least 50%.

The contribution of co-authors: The co-authors contributed to the conception of the study, data collection, interpretation of the data, and contributed to drafting and revising the manuscript.

Name: Kamil Izydorczak,

Institution: SWPS University of Social Sciences and Humanities

Email: kizydorczak@swps.edu.pl

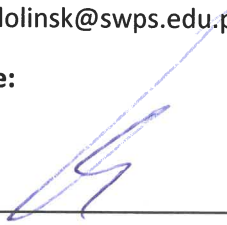
Signature:

Name: Dariusz Doliński,

Institution: SWPS University of Social Sciences and Humanities

Email: ddolinsk@swps.edu.pl

Signature:



Artykuł 1 - Ascent of Humans: Investigating methodological and ethical concerns about the measurement.

UNIVERSITY of CALIFORNIA PRESS | Collabra: Psychology

Izydorczak, K., Grzyb, T., & Dolinski, D. (2022). Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement. *Collabra: Psychology*, *8*(1). https://doi.org/10.1525/collabra.33297

Social Psychology

Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement

Kamil Izydorczak[1] [a], Tomasz Grzyb[1], Dariusz Dolinski[1]

[1] Faculty of Psychology in Wrocław, SWPS University of Social Sciences and Humanities, Wrocław, Poland

Keywords: dehumanisation, prejudice, Ascent of Humans, Blatant dehumanisation, methodology, ethics, measurement, validity

https://doi.org/10.1525/collabra.33297

Collabra: Psychology

Vol. 8, Issue 1, 2022

In this pre-registered study on a representative Polish sample (n = 1751), we aimed to test two potential critical issues with the *Ascent of Humans* scale. First, we tested whether the scores may be influenced by peripheral and previously undiscussed properties of the measurement: position of the slider-scale dot and the pattern of groups' display. Second, we tested whether participation in *Ascent of Humans* measurement may influence the attitudes towards out-groups, making participants more prejudiced. All our predictions were conclusively disconfirmed. Additionally, we explored the distribution of *Ascent of Humans*, discovering large inflation of scores indicating the absence of dehumanisation. We discuss implications of our findings for improving theoretical grounds of dehumanisation and its measurement.

Introduction

Since the Ascent of Humans (AoH) scale was introduced in 2015, it has been used in 16 published studies and mentioned in 389 articles (based on Google Scholar citations of Kteily et al., 2015 as of August 2, 2021). Findings based on these methods have been cited by the Washington Post (Kteily & Bruneau, 2015) and numerous online media sources. Considering its impact, novelty, and unorthodox approach to measure dehumanisation, critical analysis of this method by an independent research team could be a valuable contribution as no such analysis has been published yet.

This study investigates whether results obtained by this scale could be biased and whether the measurement could impact views toward an out-group, rather than simply measuring them.

Dehumanisation and Its Measurement

Defining and measuring the degree of humanity attributed to groups and individuals is a goal of social and scientific importance. Categorising individuals as 'human beings' is a predicate of their inclusion in a circle of moral consideration (Leyens et al., 2003) and in a group of privileged legal status (Bastian et al., 2011). The dynamics of humanisation and dehumanisation could also shape state policy regarding the expansion or limitation of rights and inclusion/exclusion from mainstream society and culture (Esses et al., 2008; Tileagă, 2007).

Researchers' interest in dehumanisation is also sparked by its historical importance. It is evident that dehumanisation accompanies the horrors of intergroup and international conflicts that we most certainly strive to avoid. Research often invokes examples of Tutsi and Hutu, German Nazis (Haslam, 2006), or more recent examples, such as the ongoing Israeli-Palestinian conflict (Bruneau & Kteily, 2017; Kteily et al., 2015). Although it is still unknown whether dehumanisation leads to aggression or vice versa, the co-occurrence is clear. Therefore, researchers hope that examining intergroup dehumanisation will lead to the understanding and prevention of intergroup atrocities.

In summary, there are many reasons why researchers seek to measure dehumanisation. Nonetheless, addressing the question of how to do it is complicated, and the history of such endeavours is brief— the field of social psychology has been empirically measuring dehumanisation for less than two decades (Castano & Kofta, 2009).

When discussing the measurement of dehumanisation, two distinctive approaches (indirect and direct) can be distinguished, each of which comes with benefits and risks.

The indirect approach appeared first. The pioneering and influential work of Leyens and colleagues (2000) on emotional infrahumanisation established the field of empirical studies and measurements. In infrahumanisation, the degree of humanness is defined through differences in the attribution of secondary emotions between the in-group and the out-group (Leyens et al., 2007). A subsequent indirect approach was introduced in the concepts of mechanistic

a Correspondence concerning this this article should be addressed to Kamil Izydorczak, SWPS University of Social Sciences and Humanities
Faculty of Psychology in Wroclaw, Aleksandra Ostrowskiego 30b, 50-505 Wroclaw, Poland. Contact: kizydorczak@swps.edu.pl

and animalistic dehumanisation (Haslam, 2006), where the degree of humanness was defined by traits the general public believes to be 'uniquely human' (not shared with animals) and characteristic of 'human nature' (absent in automata).

Under the indirect approach, respondents do not explicitly evaluate how human-like an individual or group seems. Instead, researchers identify and develop a list of traits they believe are qualities of human beings. Respondents are then asked to rate individuals based on the degree they believe someone possesses them.

Researchers are able to understand exactly what concept of humanity respondents are invoking as it is the same one that the researchers developed. This makes the measurement more reliable and valid. Nonetheless, there is a major drawback: it is up to the researcher to establish what it means to be human. There is a possibility that responding to the listed traits or properties does not equate to concluding humanness as a whole. Even if certain participants evaluate a group to be very low on each of the qualities, they might disagree if asked whether they considered a group non-human.

The AoH scale (Kteily et al., 2015) is the latest development in measuring dehumanisation and represents a direct approach. Researchers allow respondents to formulate their own definition of humanity and directly ask them how human they think a given group is.

The AoH measurement was introduced in response to the need to investigate the most blatant forms of dehumanisation. While straightforward, aggressive forms of dehumanisation spark interest in the topic, most studies investigate its subtle forms (Kteily et al., 2015). Subtle measurements are valid, reliable, and theoretically well-grounded, however, they miss a crucial element in intergroup hostility: overtly thinking about others as animals. To address this gap, Kteily and colleagues (2015) proposed a one-item scale. It includes a direct question about the degree of humanity/animality. Responses are indicated using a slider scale located below a schematic illustration of human evolution. The proposed method is 'brief, face-valid and intuitive and it theoretically (…) captures a number of important characteristics of blatant dehumanization' (Kteily et al., 2015, p. 4)

Extensive research, with some garnering increased public attention, following the AoH approach, has demonstrated that the method addresses a theoretically and socially salient issue. As it turns out, blatant dehumanisation not only remains prevalent among many societies but also predicts violent attitudes better than subtle measurements (Kteily et al., 2015). Multiple studies have demonstrated a correlation between results of the AoH scale and theoretically expected beliefs, opinions, and traits (e.g. Kteily et al., 2015, Kteily & Bruneau, 2017, Bruneau et al., 2018).

Ascent of Humans—Methodological and Ethical Aspects

The AoH measurement is preferable over subtle measurements because researchers are not forced to make arbitrary decisions about what makes someone 'human'. Moreover, the measurement provides an opportunity to examine previously under-researched, overt forms of dehumanisation. However, it has limitations.

By allowing the humanness to be freely interpreted by the respondents, researchers limit their possibility of understanding, what is the exact substance of the attitude which respondents express. This poses a particular problem in the case of dehumanisation measurement since 'humanness' is especially prone to distinct interpretations (Giner-Sorolla et al., 2021).

This leads to questioning how results generated by AoH should be interpreted. It is assumed that results reflect existing and consciously held beliefs about lesser degrees of humanness. However, the possibility that besides respondents' beliefs, the social situation of the measurement along with its features can impact the results, remains unexamined.

According to the tacit, but fundamental, assumption of classical test theory (Novick, 1966), the measurement process does not influence the measured variable. It reflects the 'real result' with a smaller or larger margin of error, but it does not make the real result itself, smaller or larger. Unfortunately, in the domain of psychological questionnaires, such consequences cannot be excluded.

When asked about certain matters, respondents form an opinion even though they have no real interest or knowledge of the topic, and such opinions may easily shift (Sigelman & Thomas, 1984). Furthermore, they may also express 'opinions on non-existent topics', a phenomenon known in political science and consumer research as 'pseudo-opinions' (Bishop et al., 1980).

This does not mean that participants draw their responses from a vacuum. They base them on general convictions or political stances (Sturgis & Smith, 2010). Questionnaires that produce pseudo-opinions do not measure 'nothing,' nor do they measure what they overtly inquire about.

Another problem with measurements in psychological research is the dependence of results on circumstantial variables created by the measurement situation itself. Measurement, just like any other research procedure, is a social situation in which people do not simply express their inner, authentic, and spontaneous tendencies. Each time people are asked about something, they do not merely respond to the stated question. They also respond to imagined or actual expectations of social situations (Rosenthal, 1963). Although the researcher or developer of the method may strive to avoid suggesting the hypotheses or expressing any expectations, participants may subjectively perceive them and act accordingly.

Another means by which measurement can result in much more than just capturing an existing state is the anchoring mechanism. When we are asked to make a statement or guess about something, our judgments are unconsciously affected by the subtle clues provided in the question (Tversky & Kahneman, 1974). Most typically a cue can be an initial reference point 'X' given in a question such as: 'Is it more than "X" or less than "X"?' There is a great deal of evidence indicating that people tend to evaluate close to 'X,' even if 'X' is markedly distant from the true value (Furnham & Boo, 2011).

Anchors can also be more subtle, even subliminal (Re-

itsma-van Rooijen & L. Daamen, 2006); thus, it is reasonable to suspect that the type or presentation of the research topic can form a reference point that helps people to find 'the right answer' (Strack et al., 2016). For the AoH measurement, the following questions could be posed: What is the influence of the initial position indicator on the slider scale? What is the influence of the combined display of an in-group on out-groups on a single screen?

Moreover, we would like to challenge the implicit assumption that asking whether people are fully human is harmless and morally neutral. This issue is most important from an ethical perspective.

It is possible that, at least partly, awareness of social norms is what keeps people from endorsing and expressing prejudice. When these norms are dismantled, for example, through the influence of an authority figure or a shift in political discourse, prejudice intensifies among members of a given society, and they re-evaluate their views. When norms about prejudice seem to be more permissive, individuals think of themselves as less prejudiced, as they compare themselves to a more bigoted 'average citizen' (Crandall et al., 2018).

We argue that posing a question about the degree of humanity can signal norms, as it provides clear permission to think about others in a blatantly dehumanising way. By asking this question, the questioner establishes a premise that differences in humanness may exist, and that expressing views about them is reasonable and appropriate. Notably, the AoH scale does not provide the respondent with an opportunity to become aware of this premise and respond to it (e.g. in the form of a pre-question 'Do you believe that there are differences in the level of humanness among groups of people?'). Instead, the scale follows the default implicit assumption that the respondent subscribes to the notion of varying degrees of humanness.

Theoretically, respondents can express a view indicating no differences in the degree of humanness, but the presented default assumption may lead them away from this view. The influence of 'defaults' has been demonstrated in critically important decisions with real-life consequences, such as organ donation (Johnson & Goldstein, 2004). Similar patterns are expected in less engaging situations, such as the anonymous completion of an online questionnaire. Furthermore, as mentioned earlier, it has been empirically demonstrated that people can act in accordance with implicit assumptions of questionnaires, for example, by stating opinions about non-existent topics or presenting knowledge about matters they have previously declared a lack of knowledge.

Another reason why we believe that the AoH measurement can affect respondents' views on an out-group is the phenomenon of associative/context priming (DeCoster & Claypool, 2004; Zeelenberg et al., 2003).

It has been demonstrated that when two stimuli are presented simultaneously, one can prime associations with the other. The associations between derogated out-groups and different animals are common. They are constrained by social norms, but individuals can easily encounter them outside the mainstream media, even if they may not endorse them. Henceforth, animal-out-group associations are present in the memory and displaying a visual that links them can make them more cognitively available, which may affect subsequent processes of judgement.

We assume that anchoring, implicit assumptions, and associative priming may impact results of questionnaires because respondents are subjected to the immanent processes of social and cognitive information processing, not because they are directly affected by the researchers' intentions. All these features may not be consciously or intentionally introduced by researchers, however as they are subjectively perceived, they play an important role.

Research Problem

We argue that the peripheral features of the AoH scale, which are not theoretically justified, may substantially affect results. If this is the case, it could be problematic to identify the degree to which results generated by the measurement reflect the 'real level' of a latent value, and to what degree they are a by-product of a complex measurement situation encompassing cognitive and social features.

First, we would like to note the issue of the initial placement of the dot on the slider scale below the AoH illustration. According to the illustration in the paper introducing the method (Kteily et al., 2015), the dot is placed on the extreme left, under the picture of the least developed creature – a quadrupedal monkey. The same dot position was used in the questionnaire file for online research, which was shared with us by courtesy of Nour S. Kteily (private correspondence, 2018), and in many subsequent illustrations from papers using the AoH scale.

While the authors of the first paper describing the method discuss some peripheral elements of the measurement (such as instruction), they do discuss to the position of the dot, which may also be an important feature. We theorise that the choice of initial dot position may have non-trivial, theoretically important consequences for the measurement through changes in the implicit premises about the level of humanity and changes in the meaning of moving the dot.

Placing the dot at the extreme right would create a default '100%' level of humanity, which could reflect the premise that all groups are biologically complete human beings. In this case, moving the dot would mean diminishing the initial full humanity of the group, ergo dehumanising it.

Placing the dot on the extreme left, chosen by the authors, sets the default level of humanity as "0%", which could suggest a different theoretical assumption (e.g. that humanity is a "hard to earn" status). In this case, the respondent decides how much humanity to add above the initial 'zero', and therefore moving the dot means humanisation.

It can be argued that the dot should be placed in the middle, as this gives respondents the same degree of choice when moving left and right, or that there should be no dot on the screen at all, which seems the most theoretically-neutral option.

Whatever position is chosen, this property of the measurement could benefit from theoretical reflection and justification. Moreover, important empirical consequences of the extreme left position could be suspected. Through anchoring mechanisms, such a placement could lower the

score, as the initial position of the dot can serve as an anchoring point in the evaluation process (Furnham & Boo, 2011; Reitsma-van Rooijen & L. Daamen, 2006; Tversky & Kahneman, 1974).

Another potential issue is the display of the groups. In the original method, all evaluated groups were displayed on the same page. This feature of the measurement situation has also been left undiscussed, while we argue that it may be important for results.

Considering measurement as a social situation in which participants may seek to guess hidden expectations and rules, we argue that displaying the groups together along with the instructions which read: 'Some people think that people can vary in how human-like they seem (...)' can result in the impression that the expectation of the task is to indicate the differences. First, such instruction can serve as social proof for the validity of the idea that people present different levels of humanness. Second, when all the groups are presented together, participants can more easily diversify their responses, without remembering them. Summing up, the display pattern where respondents could easily see all their answers, along with instructions encouraging to indicate differences, could result in increased variability of scores.

Considering all these reasons, we argue that participating in the AoH measurement can affect views about others. By removing a social taboo, introducing the premise that differences in degrees of humanness exist, and strengthening and invoking associative primes between humans and animals, the AoH measurement could induce dehumanisation rather than just measure it.

To address these concerns, we investigate three research problems.

First, we evaluate whether the initial placement of the dot affects scores obtained by the AoH scale. To do so, we manipulate the dot's position, creating three conditions. In the control condition, the dot is placed where it appears originally, on the extreme left. In the two experimental conditions, the dot is placed in the middle and extreme right.

We hypothesise that because of the anchoring-adjustment heuristic (Furnham & Boo, 2011; Tversky & Kahneman, 1974), the middle position will result in substantially higher scores than the left position (H1), while the right position will yield higher results than the middle position (H2). We suppose that this effect will occur only with respect to highly derogated out-groups because of the ceiling effect— scores for a favoured out-group may be too high to be heightened further. From recent public opinion polls, we conclude that the most disregarded out-groups for the intended population are Muslim refugees, Arabs, Roma, and Russians (Omyła-Rudzka, 2019; Stefaniak et al., 2017). Therefore, we propose the first two hypotheses with respect to them.

Second, we investigate the role of the display pattern of groups in creating variability among results for different groups. Due to the perceived social expectation mechanism and cognitive availability, combined with anchoring heuristics, we expect that the mean within-subject variance will be higher when groups are displayed all at once. We hypothesise that the scores for different groups will be differentiated when groups are displayed together (H3).

To test this hypothesis, we introduce two conditions. In the control condition, the display pattern from the original study is retained, which means that the groups are presented simultaneously, one below the other, in random order. In the experimental condition, the random sequence of groups is retained, but every group is displayed separately with no possibility of seeing previously given scores.

Third, we examine the impact of participating in the AoH measurement on attitudes toward out-groups. We suppose that participating in the AoH scale can shift beliefs about an out-group, such that after responding to the scale, individuals may hold more dehumanising views (H4) and more prejudice (H5) toward the groups which they were asked about.

To test these hypotheses, we measure the level of prejudice and infrahumanisation at the end of all AoH trials. Scores for prejudice and infrahumanisation are compared after completing the AoH scale with the results of the control group, who will respond to a bogus questionnaire of similar length and structure, free of intergroup and human/animal connotations.

In addition to the third research problem, we address how the impact of the AoH scale can be compared to the impact of a similar prejudice-related scale. If the AoH can influence attitudes toward groups, can the same be said about other, similar measurements? To test this, we introduce another condition with a 'Feeling thermometer' scale. The 'Feeling thermometer' is similar to the AoH scale. It utilises a slider scale and encompasses a metaphorical way of expressing a positive or negative attitude. It differs in that it does not lift any social taboo, and neither image nor instruction contains any suggestion of generic, essential differences between social groups. Therefore, we suppose that infrahumanisation of out-groups would be greater after responding to the AoH than the 'Feeling thermometer' scale (H6).

The results of this study are valuable, regardless of whether hypotheses were confirmed. Every instance in which the hypotheses are proven wrong could be interpreted in favour of robustness and ethical feasibility of the method. Note that if the measure proves to be unaffected by the anchoring effect or by cognitive clues suggesting the researchers' expectations, it could be treated as evidence in favour of both the reality of blatant dehumanisation and the reliability of the method. If all hypotheses are proven wrong, it could mean that the AoH measurement follows assumptions of the classical test theory in the sense that it does not influence the measured variable. It could also mean that the measured disposition towards a group is generally well established so that it manifests itself in the same way regardless of changes in the measurement situation.

Method

To test the hypotheses, we conducted an experimental study involving participants via an online panel. The analysis was performed using the Bayesian approach, with all hypotheses pre-registered via the Open-Science Framework using the template by van't Veer and Giner-Sorolla (2016). All materials and data are freely available through an online repository (https://osf.io/c5k8q/).

Deviations from Pre-registered Protocol

Regarding the missing data handling, we decided to deviate from pre-registered protocol. It turned out that our pre-registered criteria for data exclusion proved inadequate to meaningfully detect the low-effort and suspicious responses and there are better alternatives possible. Here are lists of changes along with their justifications:

1. Instead of using open questions to screen-out suspicious responses, we used a quality-check tool, provided by Qualtrics - "ExpertReview". This tool analyses re-captcha scores, time of completion, duplicate responses and pattern of missing responses to identify low-quality data. We decided that this automatic tool would serve our goal much better than our arbitrary, qualitative analysis. At the time of pre-registration, we were not aware of this tool being available.
2. We decided to drop the initial idea of "forcing" responses because of the panels' recommendation against such measures. Instead, we opted for "requesting response" - if the participant left some item unanswered, they saw a completion request. The respondent could ignore the message and proceed, consciously leaving some questions unanswered. We decided that in such a case, responses could be reasonably treated as low-effort and dropped from the analysis.
3. We decided to drop the exclusion criteria regarding "(...) participants whose time of completing the questionnaire is extremely above or below typical (under and above 3 SD)". After inspecting our results, we found around 50, unevenly distributed outliers, some of them very extreme, which clearly indicated breaks in the survey completion. The standard deviation proved to be so high, that it could not form meaningful cut-off points. Furthermore, we discovered no unrealistically fast answers, and extremely long answers had not differed in quality as judged by other criteria (missing answers, ExpertReview). We concluded that since breaks do not indicate low-quality answers and cut-off criteria would be either meaningless (3 SD) or too arbitrary (alternative method chosen after data-inspection), we should not use time-based criteria for data exclusion at all. We included completion time in our database to allow independent evaluation if desired.

Participants and Data Gathering

Participants constitute a sample of the Polish population, representative of age, gender, and educational attainment. The population structure was sourced from the government's statistical office and representativeness was obtained through targeted sampling. Participants were recruited via online panel ('Ariadna'). All participants received reward points from the panel and provided informed consent. The sample composition and recruitment method reflect the design in Bruneau et al. (2018).

The desired sample was estimated using Bayes factor design analysis with fixed 'n,' described by Schönbrodt and Wagenmakers (2017). We planned to recruit 200 participants for each of the seven conditions. The hypotheses tests were assumed to be conclusive when BF ⩾ 6. This value was chosen as it is commonly interpreted as moderate support for a hypothesis (van Doorn et al., 2019), which we find to be conclusive enough to achieve the scientific goals of the study.

To compute the probability of obtaining compelling evidence given BF = 6, n = 200, and ES = 0.4, we performed a Monte Carlo simulation using the R-package 'BFDA' (Schönbrodt & Stefan, 2018). The simulation was repeated 10,000 times, with the default Cauchy prior (zero-centred, r = 0.707). We chose an effect size of 0.4 because the mean effect size of the difference between the ingroup and outgroups in the Bruneau et al. (2018) study was ES = 0.61. We decided that detecting an effect of peripheral properties that were more than half the size of the effect of the focal test would be a significant finding from a theoretical and practical perspective.

Under H1, the probability of a false negative result was < 0.01%, while that of inconclusive results was 8.7%. Under H0, the probability of a false-positive result was 0.5%, while that of inconclusive results was 31.8%. Note that the actual n was higher for testing hypotheses 1–3, as we used two or three conditions per side, resulting in 400/400 and 600/600 comparisons (see Figures 2 and 3).

Our final sample was larger than we planned because of the additional volume added from the research panel. We decided to include additional participants to maximise the utility of the used resources.

We excluded 49 participants with missing answers in non-demographic questions. Additionally, we excluded one participant with suspicious ID which did not match the pattern of the Panel's ID. Qualtrics ExpertReview quality detection system indicated eight possible records from bots, but these records contained missing answers as well, so no respondents were excluded solely on this particular criterion.

The final sample consisted of 1751 participants (927 females, 810 males, 14 missing answers, M_{age} = 42.65, SD_{age} = 14.13, ranging from 17 to 85, 14 missing answers). The participants' levels of education were: primary – 11.5%, vocational – 19.9%, secondary – 33.5% , higher – 34.3%, 14 missing answers. The participants' places of residence were: village – 39.7%, small city (up to 20k residents) – 9.3%, medium city (20k-99k residents) – 18.3%, large city (100k or more) – 31.9%, 14 missing answers.

Measurements

We used three questionnaires: AoH, Infrahumanisation and Feeling thermometer. These methods were used to evaluate eight groups: Poles (in-group), Germans, Russians, Roma, Arabs, Muslim refugees, Czechs, and Americans.

Additionally, we created a bogus measurement which was intended to serve as a control condition task in place of the AoH scale.

Ascent of humans. The measurement of blatant dehumanisation was first introduced in a study by Kteily et al. (2015). Since then, it has been used in various forms and under different names. Originally the scale was dubbed the 'Ascent of man', although most recent papers refer to it as

AoH, following recommendations from Kteily and Bruneau (2017) to make the name more inclusive.

Using Google Scholar, EBSCO, ResearchGate, and Mendeley search engines, we identified 16 works published between 2015 and 2019 using a version of the AoH scale. Of these, 12 studies were peer-reviewed papers, one was a doctoral dissertation, one was a working paper, and one was a research report from an academic research centre, while one was a conference paper announced as scheduled for publishing in a peer-reviewed journal (a list of the considered works is to be found in the Supplementary Materials and OSF repository: https://osf.io/c5k8q/).

After reviewing the sources, we concluded that the studies varied in the details of the measurement. For instance, some used reference points underneath the slider scale, while others did not. Differences were also found in the instructions presented. Most often, none of the measurement properties were directly described in full detail. They had to be deducted from presented pictures, examined from uploaded research materials, or confirmed via contact with the authors. To reach conclusions about what the most 'standard' method would look like, we combined our insights from the source review with information from direct contact and the obtained study materials.

We concluded that although there is no precise, full consensus regarding the design of the Ascent of Humans scale, the most common features have been: lack of a reference point underneath the slider scale, initial position of the dot at the extreme left, multiple groups per screen display, randomised group display order, and instructions which read: 'Some people think that people can vary in how human-like they seem. According to this view, some people seem highly evolved, whereas others seem no different than lower animals. Using the sliders below, indicate how evolved you consider the group of people to be.'

What remains unchanged throughout all investigated studies is the picture used. To the best of our knowledge, it has always been the same black-and-white graphic, depicting five silhouettes ranging from a quadrupedal monkey to an anatomically contemporary human (see: Figure 1)

The dehumanisation score for each group was obtained by subtracting the rating of an out-group from the rating of the in-group.

Based on these facts, we established the AoH scale with all of the properties described above as our reference point for experimental manipulations.

In our analysis, we used two types of AoH scores. The relative AoH score (AoH_{rel}) was computed by subtracting the score of the outgroup from that of the in-group. A higher AoH_{rel} value indicates stronger dehumanisation. The absolute score (AoH_{abs}) is the degree of humanity attributed to the group, and it can assume values from 0 to 100 (full humanity).

Prejudice. Prejudice was assessed using a feeling thermometer, a commonly used method in which participants are asked 'How warm (favourable) or cold (unfavourable) do you feel towards the following groups?' Answers are given on a 5-point scale (with two presented anchors: 1 = very unfavourable, 5 = very favourable; Haddock et al., 1993).

Relative prejudice toward each group was computed by subtracting the score of an out-group from the score of the in-group. The particular version of the method used in this study follows the prejudice measurement from Bruneau, Kteily, and Laustsen (2018).

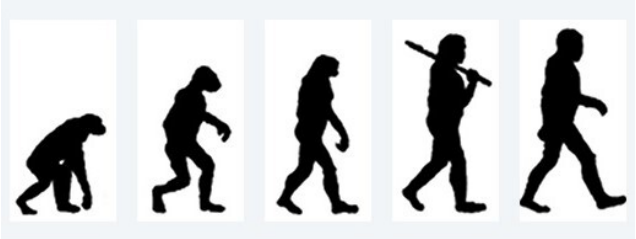


Figure 1. Illustration above the slider scale in "Ascent of Humans" measurement.

Infrahumanisation. Infrahumanisation was measured by the list of emotions originally developed by Demoulin et al. (2004) and adapted and normalised by Bilewicz, Mikołajczak, Kumagai, and Castano (2010). Based on ratings given by the respondents in the adaptation study, the research team, assisted by expert judges, chose 20 emotions, with 5 for each category: high humanity/low desirability, high humanity/high desirability, low humanity/low desirability, and low humanity/high desirability. The list was chosen with consideration to humanity/desirability scores, but also so that it does not contain redundant or obscure words.

Respondents rated the extent to which they believed the members of the group 'X' are, in general, likely to feel the given emotion, on a seven-point scale. The full list of emotions and the list chosen for this study are available at https://osf.io/c5k8q/.

Bogus scale. To conclude the influence of evaluating groups via the AoH scale, the participants in control conditions needed to be engaged in a task similar to AoH, but free of in-group/out-group and low/high humanity associations. In the control condition, participants were asked to evaluate eight different brands of mobile phones (Samsung, Apple, Huawei, LG, Alcatel, HTC, Sony Ericsson, Motorola) in terms of how innovative and modern they seemed. The instructions read:

'Some people think that brands of a mobile phone vary in how innovative and modern they seem. According to this view, some brands seem highly innovative, whereas others seem to be derivative and archaic. Using the sliders below indicates how innovative you consider the brand to be'.

Participants then saw an image of five mobile phones presented from the oldest to the most contemporary smartphone, and they were asked to evaluate the eight mobile phone brands (see Supplementary Materials or OSF repository: https://osf.io/c5k8q/)

Research Design

We randomly assigned participants to one of the eight experimental conditions.

In six (3×2) conditions, participants first completed the AoH scale with one of three dot positions (left, middle, right) combined with one of two display patterns (joint, separated). Subsequently, participants completed the 'feeling thermometer' and 'infrahumanisation' measurements

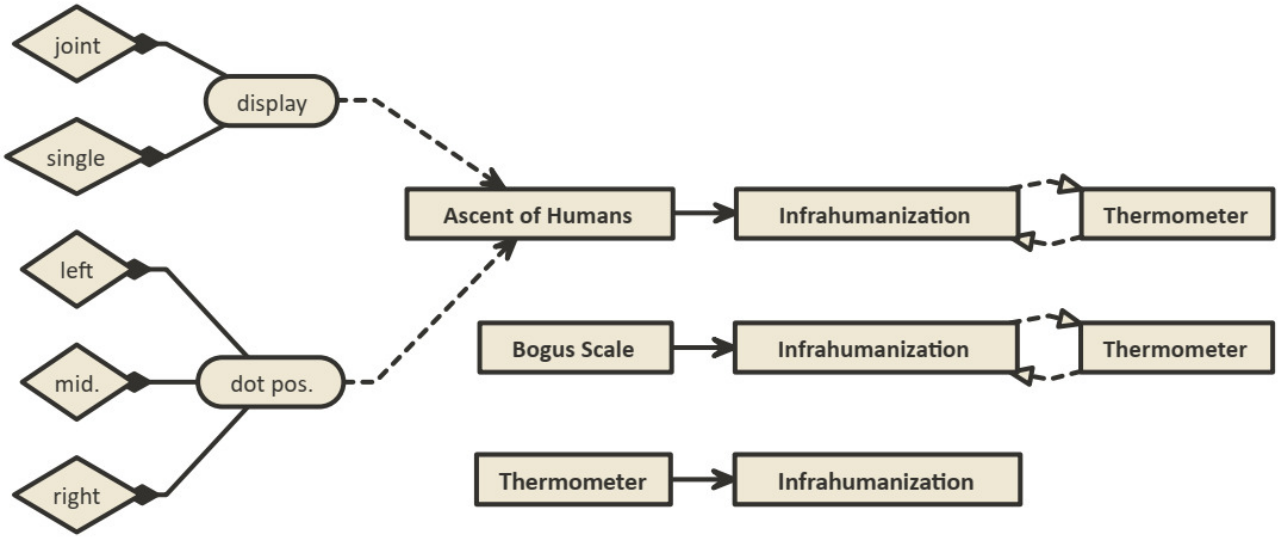


Figure 2. Diagram of experimental conditions and procedure sequence.

in a randomised order.

In the seventh condition, participants first completed a bogus scale measurement followed by the 'feeling thermometer' and 'infrahumanisation' scale in a randomised order.

In the eighth condition, participants first completed the 'feeling thermometer' scale followed by 'infrahumanisation' scale.

The order of groups was randomized across all conditions and scales.

The number of participants in each group were: AoH joint display/left dot (n = 239), AoH joint display/middle dot (n = 221), AoH joint display/right dot (n = 222), AoH seperate display/left dot (n = 223), AoH seperate display/middle dot (n = 217), AoH seperate display/right dot (n = 225), 'bogus scale' (n = 225), 'feeling thermometer' (n = 229).

The research plan for each group is summarized in Figure 2.

Data Analysis

Data analysis was conducted using the Bayesian approach. Due to the absence of previous related studies, we used default priors with a zero-centred Cauchy distribution, r = .707. As previously mentioned, a Bayesian factor of six in favour of either null or alternative hypotheses was considered conclusive. See Figure 3 for detailed list of statistical procedure and key variables in all hypotheses.

No outliers were identified in terms of the time of response or any otherwise suspicious answers. 49 respondents were removed due to missing answers in dependant variables measures, one respondent was removed from the database due to atypical respondent ID and unusual order of question display, which suggested an error in Qualtrics engine or online panel software.

Results

Here, we present the analyses of the pre-registered hypotheses along with non-pre-registered exploratory analyses. All analyses of pre-registered hypotheses are supplemented with a Bayesian factor robustness check – a method that allows testing the sensitivity of the Bayesian factor to different widths of priors distributions. Plots for these checks can be found in the OSF repository (https://osf.io/c5k8q/).

Pre-registered Analyses

All the pre-registered analyses were Bayesian Mann-Whitney-U for independent samples (van Doorn et al., 2019). In accordance with the pre-registered plan, we decided to use 'U' tests due to discrepancies between distributions of all dependent variables and the normal distribution. Specifically, all distributions were extremely left-skewed, with the mode being equal to the maximum score of the scale (100). In Figure 4, we present the combined distribution of AoH_{abs} scores for all four tested groups (Arabs, Muslim refugees, Roma, Russians).

The distributions of AoH_{abs} scores for each group followed roughly the same shape.

To formally confirm or reject hypotheses, we used the pre-registered criteria of BF > 6. The prior probability is a zero-centred Cauchy distribution with a scale parameter of .707 in all cases.

Sliders' scale dot position and the AoH score. We hypothesised (H1) that the AoH_{abs} score for the left dot position (n = 452) would be substantially lower than that for the middle (n = 419). The null hypothesis was $\delta = 0$, and the alternative was directional: $\delta < 0$. We obtained the following results:

- Inconclusive results for Roma: BF_{01}= 2.44, posterior effect size distribution was centred around Glass's δ = -.11, 95% *CI* [-.24, -.01]

	Hypotheses	Tested groups	Tested variables	Tests
H1	Mean raw "AoH" score for dot left < dot middle	all dot left "AoH" all dot middle "AoH"	"AoH" scores for Muslim refugees, Arabs, Roma and Russians	Bayesian t-test between independent groups for mean of scores
H2	Mean raw "AoH" score for dot middle < dot right	all dot middle "AoH" all dot right "AoH"	"AoH" scores for groups: Muslim refugees, Arabs, Roma and Russians	As above
H3	Mean within-subject variance of raw "AoH" scores for different groups for separate display > joint display	all sep. display "AoH" all joint display "AoH"	"AoH" within-subject variance of scores for all seven out-groups	Bayesian t-test between independent groups for mean within subject variance
H4	Mean "infrahumanization" score after "AoH" measurement > after bogus-scale	dot left & joint display "AoH" "bogus scale"	"Infrahumanization" score for all seven out-groups	Bayesian t-test between independent groups for mean of scores
H5	Mean "feeling thermometer" score after "AoH" measurement < after bogus-scale	dot left & joint display "AoH" "bogus scale"	"Feeling thermometer score for all seven out-groups	As above
H6	Mean "infrahumanization" score after "feeling thermometer" < after "AoH" scale	"thermometer" first dot left & joint dislay "AoH"	"Infrahumanization" score for all seven out-groups	As above

Figure 3. Summary of hypotheses with corresponding groups, variables and planned analyses.

- Inconclusive results for Russians: BF_{01} = 4.04, posterior effect size distribution was centred around Glass's δ = -.09, 95% *CI* [-.22, -.01]
- Data in favour of the H0 for Arabs: BF_{01} = 7.15, posterior effect size distribution was centred around Glass's δ = -.07, 95% *CI* [-.20, -.01]
- Data in favour of the H0 for Muslim refugees: BF_{01} = 10.17, posterior effect size distribution was centred around Glass's δ = -.06, 95% *CI* [-.17, - <.01]

Analogically, we expected (H2) that the AoH_{abs} score for the middle (n = 419) dot would be substantially lower than the score for the left dot (n = 421). The null hypothesis was δ = 0, and the alternative hypothesis was directional: δ < 0. We obtained the following results:

- Data in favour of the H0 for Roma: BF_{01} = 19.89, posterior effect size distribution was centred around Glass's δ = -.03, 95% *CI* [-.13, - <.01]
- Data in favour of the H0 for Russians: BF_{01} = 23.61, posterior effect size distribution was centred around Glass's δ = -.03, 95% *CI* [-.12, - <.01]
- Data in favour of the H0 for Arabs: BF_{01} = 18.11, posterior effect size distribution was centred around Glass's δ = -.04, 95% *CI* [-.14, - <.01]
- Data in favour of the H0 for Muslim refugees: BF_{01} = 15.79, posterior effect size distribution was centred around Glass's δ = -.04, 95% *CI* [-.14, - <.01]

Given our criteria, both hypotheses regarding the influence of dot position were either disconfirmed or inconclusive.

Group display pattern and the within-subject variance of AoH_{abs} score. We verified the hypothesis that when groups are displayed on a single screen, one below the other, the AoH_{abs} scores will be more varied than when groups are displayed on a single screen (H3).

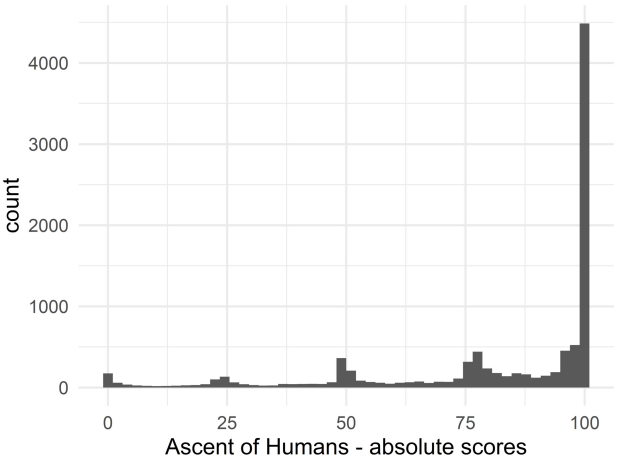


Figure 4. Distribution of absolute AoH score for all groups combined.

To test this, we computed the within-subject variance for all the groups' scores and then tested the difference in variances between the joint display (n = 651) and separate-display groups (n = 649). The null hypothesis was δ = 0, and the alternative was directional: δ < 0.

The data was strongly in favour of the null hypothesis: BF_{01} = 51.84, posterior effect size distribution was centred around Glass's δ = .02, 95% *CI* [.00, .05].

Impact of participating in the AoH measurement on attitudes toward out-groups. With respect to the second problem, we verified three hypotheses:

Table 1. Bayesian Mann-Whitney U Test for comparison of AoH and bogus group on infrahumanisation (H4).

	BF_{+0}	BF_{0+}	W	Rhat	Posterior median effect size (δ)	Lower 95 CI	Upper 95 CI
Arabs	0.13	7.47	25571.50	1.00	0.08	< 0.01	0.24
Roma	0.33	3.04	27217.50	1.00	0.12	0.01	0.30
Russians	0.15	6.74	26018.00	1.00	0.08	< 0.01	0.24
Muslim refugees	0.23	4.40	27103.00	1.00	0.10	0.01	0.28

Note. For all tests, the alternative hypothesis specifies that group *AoH* is greater than group *bogus*.
Note. Result based on data augmentation algorithm with 5 chains of 1000 iterations.

Table 2. Bayesian Mann-Whitney U Test for comparison of AoH and bogus group on feeling thermometer (H5).

	BF_{+0}	BF_{0+}	W	Rhat	Posterior median effect size (δ)	Lower 95 CI	Upper 95 CI
Arabs	0.06	17.80	24337.50	1.00	0.04	< 0.01	0.16
Roma	0.14	7.14	26240.00	1.00	0.08	< 0.01	0.24
Russians	0.09	11.05	24956.00	1.00	0.06	< 0.01	0.20
Muslim refugees	0.08	11.71	25161.50	1.00	0.05	< 0.01	0.19

Note. For all tests, the alternative hypothesis specifies that group *AoH* is greater than group *bogus*.
Note. Result based on data augmentation algorithm with 5 chains of 1000 iterations.

- H4: Participating in AoH measurement will result in higher infrahumanisation scores toward out-groups when compared with participating in the bogus scale measurement.
- H5: Participating in AoH measurement will result in higher feeling thermometer scores toward out-groups when compared with participating in the bogus scale measurement (note that a higher feeling thermometer score indicates more prejudice toward out-group).
- H6: Participating in AoH measurement will result in higher infrahumanisation scores toward out-groups when compared with participating in feeling thermometer measurements.

We tested a group of participants previously engaged in the standard AoH measurement (left dot, joint display) versus the group who completed a bogus scale (see p. 21 and Figure 2) or feeling thermometer scale.

For all three hypotheses, the null hypothesis was $\delta = 0$, and the alternative was $\delta > 0$.

Infrahumanisation scores for all four out-groups proved to be marginally influenced or independent of prior engagement in the AoH measurement. The Bayesian factor in favour of the null hypothesis ranged from $BF_{01} = 7.47$ for Arabs and $BF_{01} = 3.04$ for Roma. This indicates that evidence from the data ranged from inconclusiveness to moderate support for the null hypothesis (Table 1).

Feeling thermometer scores were also unaffected by prior engagement in the AoH versus the bogus scale. The Bayesian Factor in favour of the null hypothesis ranged from $BF_{01} = 7.14$ for the Roma and $BF_{01} = 17.80$ for Arabs, which provided moderate to strong support for the null hypothesis (Lee & Wagenmakers, 2013; Table 2).

The last pre-registered hypothesis stated that participating in AoH measurement will have a stronger influence on out-group derogation than participating in a somewhat similar slider-based measurement: the feeling thermometer. The null hypothesis was $\delta = 0$ and the alternative was $\delta > 0$.

In all four tested out-groups, the Bayesian Factor favoured the null hypothesis, but only in two of them, BF reached a conclusiveness threshold ($BF_{01} = 8.79$ for Muslim refugees and $BF_{01} = 13.01$ for Roma). The Bayesian factors for Russians and Arabs are inconclusive.

In summary, evidence suggests that we should shift our beliefs towards the notion that participants previously engaged in AoH measurement are just as likely to infrahumanise as those who responded to the feeling thermometer scale (Table 3).

Notably, owing to the sample plan analysis (see section Participants and Data Gathering), we know that inconclusiveness is substantially more probable under the true null hypothesis than the alternative. Another plausible interpretation for the inconclusive results is that some effects may exist, but their sizes are below the minimum effect of interest.

Exploratory Analyses

In addition to the pre-registered analysis, we decided to explore the database in search of additional valuable insights and inspiration for future research. We decided to explore three areas: (1) relationships between AoH, prejudice, and infrahumanisation, (2) the prevalence of blatant dehumanisation of various out-groups, and (3) the distribution of AoH scores.

Table 3. Bayesian Mann-Whitney U Test for comparison of AoH and 'thermo' group on infrahumanisation.

	BF_{+0}	BF_{0+}	W	Rhat	Posterior median effect size (δ)	Lower 95 CI	Upper 95 CI
Arabs	0.99	1.01	28428.00	1.01	0.17	0.02	0.35
Roma	0.08	13.01	25712.50	1.00	0.05	0.00	0.19
Russians	0.19	5.18	27060.00	1.00	0.09	0.01	0.26
Muslim refugees	0.11	8.97	26468.00	1.00	0.06	0.00	0.22

Note. For all tests, the alternative hypothesis specifies that group *AoH* is greater than group *bogus*.
Note. Result based on data augmentation algorithm with 5 chains of 1000 iterations.

Table 4. Mean relative AoH scores in current study versus in the study by Bruneau et al. (2018).

Mean AoH_{rel}	Germans	Muslim Refugees	Roma	Russians
Current study (Poland)	-2.07	18.57	13.41	8.69
Bruneau et al., 2018, Study 1 (Czech Republic)	.5	37.5	38.7	11.8
Bruneau et al., 2018, Study 2 (Hungary)	0.0	26.0	27.6	--

Relationship between Blatant Dehumanisation, Infrahumanisation and Prejudice. Measures of blatant dehumanisation, infrahumanisation, and prejudice proved to be interrelated. Due to the highly skewed distribution of all variables, we used a non-parametric Kendall's tau-b coefficients with default prior distribution (zero-centred, beta = 1). The strongest relationship was between blatant dehumanisation (AoH_{rel}) and prejudice (feeling thermometer). The correlation for all out-groups combined was $r_\tau(9008) = .36$, 95% CI [.35, .37], $BF_{10} > 1000$. The correlation between AoH_{rel} and infrahumanisation was also significant, but much smaller, $r_\tau(9008) = .06$, 95% CI [.05, .07], $BF_{10} > 1000$.

These results replicate the pattern identified in previous studies, in which AoH scores proved to be highly correlated with measurements of explicit prejudice and mildly correlated with other measurements of dehumanisation (Kteily et al., 2015; Kteily & Bruneau, 2017). Moreover, the infrahumanisation score was correlated with the feeling thermometer scale: $r_\tau(9008) = .11$, 95% CI [.10, .12], $BF_{10} > 1000$.

Interestingly, the more the out-group was negatively perceived, the stronger the association between blatant dehumanisation and prejudice. For the most disfavoured groups, Muslim refugees, Arabs, and Roma, the correlations were $r_\tau(1283) = .40$, 95% CI [.37, .44], $BF_{10} > 1000$; $r_\tau(1287) = .34$, 95% CI [.31, .38], $BF_{10} > 1000$; and $r_\tau(1285) = .33$, 95% CI [.30, .37], $BF_{10} > 1000$, respectively. For most favourably viewed Americans, this effect was about half the size: $r_\tau(1291) = .18$, 95% CI [.14, .21], $BF_{10} > 1000$.

Prevalence of blatant dehumanisation of various out-groups and distribution of scores. Our choice of out-groups, population, and measurement methods was based on the study by Bruneau et al. (2018). Thus, we compare our results with those of this work. We present two types of AoH scores: relative and absolute. The relative AoH score (AoH_{rel}) was computed by subtracting the score of the out-group from that of the in-group. A higher AoH_{rel} value indicates stronger dehumanisation. The absolute score (AoH_{abs}) is the degree of humanity attributed to the group, and it can assume values from 0 to 100 (full humanity).

In accordance with our expectations, the four groups that we assumed to be negatively perceived stood out from other groups in AoH_{rel} scores. Similar to the results obtained by Bruneau et al. (2018) on Central European samples (Hungary and the Czech Republic), Muslim refugees ($M = 18.6$, $SD = 28.86$), and Roma ($M = 13.46$, $SD = 25.16$) proved to be most blatantly dehumanised. However, the degree of dehumanisation was smaller than that in the original study (Table 4).

Regarding groups which we assumed to be positively perceived (Czechs, Germans, and Americans), we found no substantial evidence for widespread dehumanisation. Moreover, Germans and Czechs were estimated to be even slightly more human than the in-group (AoH_{rel} for Germans: $M = -2.07$, $SD = 20.01$, Czechs: $M = -.15$, $SD = 19.24$).

We examined the average scores, but a quick glimpse at the distribution plots led us to the conclusion that Mean or any other measure of central tendency neglects important information.

Figure 5 shows the distribution of AoH_{abs} scores. The panels are sorted in descending order of the mean AoH_{abs}. The top-left panel displays the distribution for the most humanised group (Germans) and the bottom-right, the least humanised (Muslim refugees). Most noteworthy, we observed extreme inflation of the '100' and adjacent scores for each group. Even for the most dehumanised group (Muslim refugees), 29.84% of all scores equalled 100. For the in-group (Poles), 48.74% of scores equalled 100, and for the most humanised group (Germans), 51.44%.

Beside the highly inflated peak at '100', the distribution was close to uniform, with some small peaks at values: '0', '25', '50' and '75'.

In summary, we can identify three distinctive features of the AoH_{abs} distribution:

1. The scores are always strongly concentrated on the

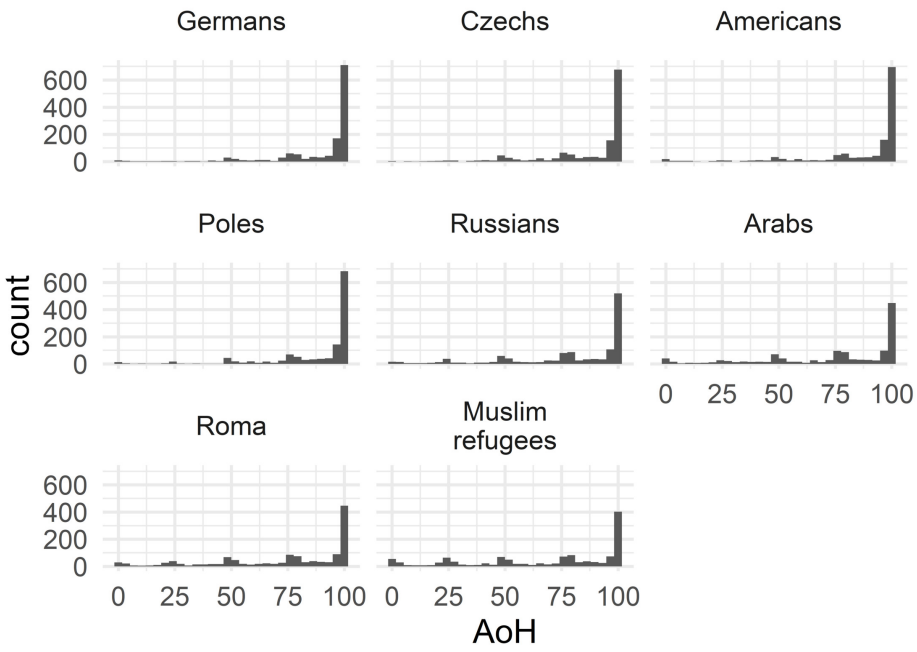


Figure 5. Distribution of absolute AoH scores for all groups.

highest possible value
2. Lower values are distributed along minimally left-skewed, almost horizontal lines
3. There are small peaks at the four evenly spaced areas

We suppose that these peaks are caused by silhouettes above those areas (see Figure 4). These pictures may serve as distinct, visible cues. After all, the anchoring mechanism may have been in play, but the anchors turned out to be pictures rather than slider-dots.

Figure 6 shows the violin plots of the distribution of the AoH_{rel} scores sorted by the increasing mean AoH_{rel} score.

The plots do not resemble 'violins', because they represent a peculiar distribution. What is striking is the completely different shape of the distribution for positively perceived (Germans, Czechs, and Americans) and negatively perceived out-groups (Russians, Arabs, Roma, and Muslim refugees). For the first three out-groups, we can see a massive concentration of the results around '0'. These 'disks' in the middle represent a large portion of scores showing virtually no relative dehumanisation.

When it comes to four negatively perceived out-groups, we can see that $AoH_{rel} = 0$ is only mildly dominant and scores slightly below and above zero are quite common as well.

Furthermore, one can notice that even in the case of the highest mean AoH_{rel} score (represented by the dots), the cluster of central-tendency scores remain in the same place (around 0). It is the shape of this cluster and the small amount of the above-central tendency scores that make the difference in the mean score.

What theoretical insights can be obtained from this visual analysis?

The first and most important information is that a low average AoH score for an out-group does not indicate a general consensus about their lower degree of "humanity" - it indicates less universal agreement that they are fully human. While full humanity was always the most common score, the difference between the more and less dehumanised out-groups was due to the proportion of in-group members who do not express this dominant view.

The second insight is that the complete lack of discrimination of the outgroups is not uncommon. Even in the case of most unfavourably viewed groups, there is still a significant proportion of people who do not dehumanise them. Furthermore, the in-group is also subjected to absolute dehumanisation (more than 50% of the respondents viewed their in-group as less than fully human).

Discussion

This study aimed to address the methodological and ethical issues associated with the AoH measurement through a transparent, pre-registered experimental procedure. The results of these tests were overwhelmingly disproving when it came to our concerns.

First, we hypothesised that the raw score of the AoH measurement can be substantially influenced by the slider-scale dot position or by the pattern of the group display. If our hypothesis has been confirmed, we would state that the AoH score may create a specific impression rather than capture pre-existing beliefs. Consequently, we interpret the falsification of our hypotheses as a reason to shift our beliefs toward the notion that the results of AoH measurement stem from sources other than the peripheral properties of the measurement. Overall, these results should be interpreted as evidence against the notion that AoH scores are just artefacts of a particular measurement method.

Second, and perhaps more importantly, we found a strong, conclusive disproval of our ethical and methodolog-

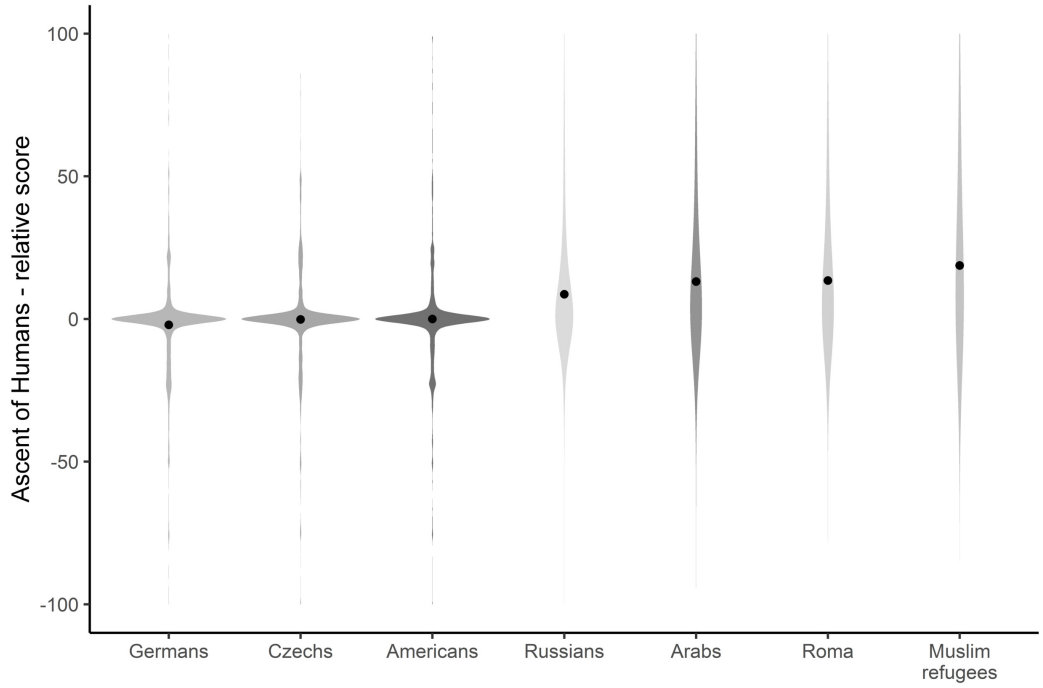


Figure 6. Violin plots of relative AoH score for all tested out-groups. Out-groups are presented in the order of ascending mean score.

ical concerns regarding the influence of participating in AoH measurement. We hypothesised that participating in AoH measurement can strengthen prejudice, resulting in a more negative perception of the out-group in the following measurements. If the hypothesis was confirmed, it would pose serious ethical concerns and cast doubt on the pre-existing body of theoretical validity evidence.

After filling out the AoH questionnaire, respondents did not express a more negative and dehumanising view of the out-groups. This discovery weakens our main ethical concern: by giving such questionnaires to the public, we might induce prejudice. Furthermore, this study provides more confidence regarding AoH scores to be a good predictor of multiple negative attitudes toward out-groups. We proved that correlations between AoH scores and other prejudice-related measurements do not stem from the uncontrolled causal effect, but rather from underlying relationships.

In addition to our main pre-registered hypothesis, we share novel insights into many characteristics of the measurement. Above all, we were able to systematically evaluate the prevalence of blatant dehumanisation in a given population.

We conclude that despite dehumanisation being visible on the mean scores for out-groups, a substantial fraction of the respondents did not dehumanise out-groups at all. After inspecting the distribution of results, it may be observed that scores indicating full humanity were massively inflated. Such a point-inflated distribution indicates the dual mechanism of responses – one mechanism account for the difference between the inflated score and the rest of the distribution and the second mechanism underlies the variability within the rest of the distribution. For instance, investigating cigarette smoking habits by asking 'how many cigarettes do you smoke weekly?' would obtain a technically continuous variable, however, analysing it just as such would be incomplete. The difference between '0' and '1' is the difference between a non-smoker and a regular smoker, and a massive inflation of '0' scores in the population may be observed.

The best approach would be to treat the difference between '0' and '1', and the variance in the rest of the scale as two separate phenomena. This will allow us to include qualitative differences between dehumanising and non-dehumanising individuals (analogous to 'smokers' and 'non-smokers'), which will not only reflect AoH scores more accurately but also provide a better insight into the relationships with other variables. There are statistical techniques that allow the modelling of such variables in a dual way. (e.g. hurdle models or zero-inflated Poisson, see: Green, 2021).

Apart from methodological aspects, the distribution of the scores provides valuable theoretical information. The percentage of respondents displaying no out-group derogation was substantially higher with AoH measurement than with other measurements from this domain. This implies that this prejudicial view is comparatively rare. Perhaps the central claim behind the development of the AoH scale – that blatant dehumanisation is still prevalent in contemporary society needs an important complement.

Blatant dehumanisation is present, yes, but is not universal, and not nearly as common as more subtle prejudice. We believe that this may be the reason why AoH is a better predictor of out-group aggression or discrimination. Out of all widely used methods, AoH may be the best at capturing a firm, consciously held prejudice. In that respect, AoH may bridge an important gap by examining blatant dehumanisa-

tion. Recent research on prejudice is often said to concentrate too much on the subtle, unconscious biases on the expanse of overtly hurtful, self-conscious, and active racism, sexism, etc., which are still an important social issue.

Limitations and Future Directions

Currently, the line of research on dehumanisation has been questioned (Over, 2021). The main concerns are theoretical: How exactly is dehumanisation defined? To what extent could it drive inter-group violence? Are the comparisons to animals universally derogative and specifically attributed to out-groups? Over (2021) argues that the proponents of dehumanisation research do not provide enough evidence to support the notion that dehumanisation was a driving factor for violence and discrimination or that historically persecuted out-groups were consequently perceived as less human. Over (2021) suggests that the main driving force behind inter-group atrocities is an extremely negative out-group perception, often focused on the arcs which make sense only when applied to human beings (traitors, schemers).

Over (2021) argues that comparisons to animals are present only when they serve to enhance and consolidate these negative connotations. Consequently, when individuals associate certain out-groups with animals, it may not necessarily mean that they think of the members as less human. This may mean that they hold strong, negative views about these out-groups and that they often came across messages that embed these views in some animal metaphors, which have now become a part of an association-net around this out-group.

Therefore, does AoH measurement provide evidence that a substantial portion of individuals think of others as not fully, biological humans? We believe that this is not necessarily the case.

Our findings refute a critical point whose confirmation would indicate that AoH scores and correlations with related concepts are largely artefacts. In this sense, we have provided evidence that AoH scores represent a certain psychological reality. However, the question remains as to what exactly this method measures.

The first paper by Kteily and colleagues (2015) examined only convergent and predictive validity, and to the best of our knowledge, no published, peer-reviewed work since the method's introduction has addressed measurement validity and reliability. Our work has significant limitations when examining the accuracy of the AoH scale as well. First, we used only a self-report questionnaire and did not control for or mitigate the social desirability of the responses. Secondly, other possible problems and important questions about the scale were not addressed, e.g. could it confuse perceptions of humanity with perceptions of 'ape-ness' or masculinity? (the pictures only depict human males, and being human is directly juxtaposed with being an ape).

Another limitation of the conclusions of our study is the dependent variables used. To maintain comparability, we chose two methods (feeling thermometer and infrahumanisation) that have been widely used in conjunction with the AoH.

However, these methods also have their limitations. The validity of the 'feelings thermometer' as a measure of prejudice is not a topic widely discussed in the literature - it is much more often used to validate other scales than in the context of testing its own validity.

The infrahumanisation index on the other hand has been shown to have moderately low test-retest reliability (r = .46, Kteily et al. 2015, p. 910). This latter point may not be crucial in the context of our results, as we were more interested in infrahumanisation as a state than a trait, but it may limit the interpretation of the infrahumanisation score as a measure of entrenched attitudes towards outgroups.

Summing up, the next important topic regarding Ascent of Humans scale is establishing whether it examines actual views of non-metaphorical, biological inferiority, or is it a well-calibrated, one-item measurement of extreme prejudice. In both cases, the method may be a valuable tool, but we believe that more research is needed to establish whether results can be interpreted at face value.

One such crucial research could be testing the predictive, discriminant validity of the blatant dehumanisation construct. If this theoretical construct is substantially different from negative attitudes, it should be possible to name an outcome that is different for highly dehumanised outgroups than for extremely negatively perceived ones. Such a study, especially with pre-registered plans and predictions, could be an important input to the current discussion regarding dehumanisation.

Contributions

Contributed to conception and design: KI. TG, DD.
Contributed to acquisition of data: KI.
Contributed to analysis and interpretation of data: KI.
Drafted and/or revised the article: KI. TG, DD.
Approved the submitted version for publication: KI. TG, DD.

Competing Interests

Authors declare no competing interests regarding presented work.

Acknowledgements

We would like to thank Michał Bilewicz for providing a valuable insights and suggestions regarding the design of the study and the measurements we could use.

Funding Information

The study has been funded by SWPS University of Social Sciences and Humanities, Faculty of Psychology (grant competition nr 1/2019/2020) from the subvention of the Ministry of Science and Higher Education, Republic of Poland.

Data Accessibility Statement

All data, reproducible files for data analyses and experimental materials are publicly accessible via Open Science

Framework.
(https://osf.io/c5k8q/)

Ethics Approval Statement

Study was approved by the SWPS University of Social Sciences and Humanities ethics review board.

Submitted: September 29, 2021 PDT, Accepted: March 04, 2022 PDT

References

Bastian, B., Laham, S. M., Wilson, S., Haslam, N., & Koval, P. (2011). Blaming, praising, and protecting our humanity: The implications of everyday dehumanization for judgments of moral status. *British Journal of Social Psychology*, *50*(3), 469–483. https://doi.org/10.1348/014466610x521383

Bilewicz, M., Mikołajczak, M., Kumagai, T., & Castano, E. (2010). Which emotions are uniquely human? Understanding of emotion words across three cultures. In B. Bokus (Ed.), *Studies in the Psychology of Language and Communication* (pp. 275–285). Matrix.

Bishop, G. F., Oldendick, R. W., Tuchfarber, A. J., & Bennett, S. E. (1980). Pseudo-Opinions on Public Affairs. *Public Opinion Quarterly*, *44*(2), 198–209. https://doi.org/10.1086/268584

Bruneau, E., & Kteily, N. (2017). The enemy as animal: Symmetric dehumanization during asymmetric warfare. *PLOS ONE*, *12*(7), e0181422. https://doi.org/10.1371/journal.pone.0181422

Bruneau, E., Kteily, N., & Laustsen, L. (2018). The unique effects of blatant dehumanization on attitudes and behavior towards Muslim refugees during the European 'refugee crisis' across four countries. *European Journal of Social Psychology*, *48*(5), 645–662. https://doi.org/10.1002/ejsp.2357

Castano, E., & Kofta, M. (2009). Dehumanization: Humanity and its Denial. *Group Processes & Intergroup Relations*, *12*(6), 695–697. https://doi.org/10.1177/1368430209350265

Crandall, C. S., Miller, J. M., & White, M. H., II. (2018). Changing Norms Following the 2016 U.S. Presidential Election: The Trump Effect on Prejudice. *Social Psychological and Personality Science*, *9*(2), 186–192. https://doi.org/10.1177/1948550617750735

DeCoster, J., & Claypool, H. M. (2004). A Meta-Analysis of Priming Effects on Impression Formation Supporting a General Model of Informational Biases. *Personality and Social Psychology Review*, *8*(1), 2–27. https://doi.org/10.1207/s15327957pspr0801_1

Demoulin, S., Leyens, J., Paladino, M., Rodriguez-Torres, R., Rodriguez-Perez, A., & Dovidio, J. (2004). Dimensions of "uniquely" and "non-uniquely" human emotions. *Cognition & Emotion*, *18*(1), 71–96. https://doi.org/10.1080/02699930244000444

Esses, V. M., Veenvliet, S., Hodson, G., & Mihic, L. (2008). Justice, Morality, and the Dehumanization of Refugees. *Social Justice Research*, *21*(1), 4–25. https://doi.org/10.1007/s11211-007-0058-4

Furnham, A., & Boo, H. C. (2011). A literature review of the anchoring effect. *The Journal of Socio-Economics*, *40*(1), 35–42. https://doi.org/10.1016/j.socec.2010.10.008

Giner-Sorolla, R., Burgmer, P., & Demir, N. (2021). Commentary on Over (2021): Well-Taken Points About Dehumanization, but Exaggeration of Challenges. *Perspectives on Psychological Science*, *16*(1), 24–27. https://doi.org/10.1177/1745691620953788

Green, J. A. (2021). Too many zeros and/or highly skewed? A tutorial on modelling health behaviour as count data with Poisson and negative binomial regression. *Health Psychology and Behavioral Medicine*, *9*(1), 436–455. https://doi.org/10.1080/21642850.2021.1920416

Haddock, G., Zanna, M. P., & Esses, V. M. (1993). Assessing the structure of prejudicial attitudes: The case of attitudes toward homosexuals. *Journal of Personality and Social Psychology*, *65*(6), 1105–1118. https://doi.org/10.1037/0022-3514.65.6.1105

Haslam, N. (2006). Dehumanization: An Integrative Review. *Personality and Social Psychology Review*, *10*(3), 252–264. https://doi.org/10.1207/s15327957pspr1003_4

Johnson, E. J., & Goldstein, D. G. (2004). Defaults and Donation Decisions. *Transplantation*, *78*(12), 1713–1716. https://doi.org/10.1097/01.tp.0000149788.10382.b2

Kteily, N., & Bruneau, E. (2015, September 18). Americans see Muslims as less than human. No wonder Ahmed was arrested. *Washington Post*. https://www.washingtonpost.com/posteverything/wp/2015/09/18/americans-see-muslims-as-less-than-human-no-wonder-ahmed-was-arrested/

Kteily, N., & Bruneau, E. (2017). Darker demons of our nature: The need to (Re)focus attention on blatant forms of dehumanization. *Current Directions in Psychological Science*, *26*(6), 487–494. https://doi.org/10.1177/0963721417708230

Kteily, N., Bruneau, E., Waytz, A., & Cotterill, S. (2015). The ascent of man: Theoretical and empirical evidence for blatant dehumanization. *Journal of Personality and Social Psychology*, *109*(5), 901–931. https://doi.org/10.1037/pspp0000048

Lee, M. D., & Wagenmakers, E.-J. (2013). *Bayesian cognitive modeling: A practical course*. Cambridge University Press. https://doi.org/10.1017/cbo9781139087759

Leyens, J.-P., Cortes, B., Demoulin, S., Dovidio, J. F., Fiske, S. T., Gaunt, R., Paladino, M.-P., Rodriguez-Perez, A., Rodriguez-Torres, R., & Vaes, J. (2003). Emotional prejudice, essentialism, and nationalism: The 2002 Tajfel Lecture. *European Journal of Social Psychology*, *33*(6), 703–717. https://doi.org/10.1002/ejsp.170

Leyens, J.-P., Demoulin, S., Vaes, J., Gaunt, R., & Paladino, M. P. (2007). Infra-humanization: The Wall of Group Differences. *Social Issues and Policy Review*, *1*(1), 139–172. https://doi.org/10.1111/j.1751-2409.2007.00006.x

Leyens, J.-P., Paladino, P. M., Rodriguez-Torres, R., Vaes, J., Demoulin, S., Rodriguez-Perez, A., & Gaunt, R. (2000). The Emotional Side of Prejudice: The Attribution of Secondary Emotions to Ingroups and Outgroups. *Personality and Social Psychology Review*, *4*(2), 186–197. https://doi.org/10.1207/s15327957pspr0402_06

Novick, M. R. (1966). The axioms and principal results of classical test theory. *Journal of Mathematical Psychology*, *3*(1), 1–18. https://doi.org/10.1016/0022-2496(66)90002-2

Omyła-Rudzka, M. (2019). *Stosunek do innych narodów. Komunikat z badań, [Attitude towards other nations. Research report.] (No. 17/2019)*. Centrum Badania Opinii Społecznej. https://cbos.pl/SPISKOM.POL/2019/K_017_19.PDF

Over, H. (2021). Seven Challenges for the Dehumanization Hypothesis. *Perspectives on Psychological Science*, *16*(1), 3–13. https://doi.org/10.1177/1745691620902133

Reitsma-van Rooijen, M., & L. Daamen, D. D. (2006). Subliminal anchoring: The effects of subliminally presented numbers on probability estimates. *Journal of Experimental Social Psychology*, *42*(3), 380–387. https://doi.org/10.1016/j.jesp.2005.05.001

Rosenthal, R. (1963). On the social psychology of the psychological experiment: The experimenter's hypothesis as unintended determinant of experimental results. *American Scientist*, *51*(2), 268–283. http://www.jstor.org/stable/27838693

Schönbrodt, F. D., & Stefan, A. M. (2018). *BFDA: An R package for Bayes factor design analysis (version 0.3)*. https://github.com/nicebread/BFDA

Schönbrodt, F. D., & Wagenmakers, E.-J. (2017). Bayes Factor Design Analysis: Planning for compelling evidence. *Psychonomic Bulletin & Review*, *25*(1), 128–142. https://doi.org/10.3758/s13423-017-1230-y

Sigelman, L., & Thomas, D. (1984). Opinion Leadership & the Crystallization of Nonattitudes: Some Experimental Results. *Polity*, *16*(3), 484–493. https://doi.org/10.2307/3234561

Stefaniak, A., Malinowska, K., & Witkowska, M. (2017). *Kontakt międzygrupowy i dystans społeczny w Polskim Sondażu Uprzedzeń [Intergroup contact and social distance in Polish Prejudice Survey], 3, 25*. http://cbu.psychologia.pl

Strack, F., Bahník, Š., & Mussweiler, T. (2016). Anchoring: Accessibility as a cause of judgmental assimilation. *Current Opinion in Psychology*, *12*, 67–70. https://doi.org/10.1016/j.copsyc.2016.06.005

Sturgis, P., & Smith, P. (2010). Fictitious Issues Revisited: Political Interest, Knowledge and the Generation of Nonattitudes. *Political Studies*, *58*(1), 66–84. https://doi.org/10.1111/j.1467-9248.2008.00773.x

Tileagă, C. (2007). Ideologies of moral exclusion: A critical discursive reframing of depersonalization, delegitimization and dehumanization. *British Journal of Social Psychology*, *46*(4), 717–737. https://doi.org/10.1348/014466607x186894

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, *185*(4157), 1124–1131. https://doi.org/10.1126/science.185.4157.1124

van Doorn, J., van den Bergh, D., Bohm, U., Dablander, F., Derks, K., Draws, T., Etz, A., Evans, N. J., Gronau, Q. F., Haaf, J. M., Hinne, M., Kucharský, Š., Ly, A., Marsman, M., Matzke, D., Raj, A., Sarafoglou, A., Stefan, A., Voelkel, J. G., & Wagenmakers, E.-J. (2019). *The JASP Guidelines for Conducting and Reporting a Bayesian Analysis*. Preprint. https://doi.org/10.31234/osf.io/yqxfr

van 't Veer, A. E., & Giner-Sorolla, R. (2016). Pre-registration in social psychology—A discussion and suggested template. *Journal of Experimental Social Psychology*, *67*, 2–12. https://doi.org/10.1016/j.jesp.2016.03.004

Zeelenberg, R., Pecher, D., & Raaijmakers, J. G. W. (2003). Associative repetition priming: A selective review and theoretical implications. In J. S. Marsolek & J. Chad (Eds.), *Rethinking implicit memory* (pp. 261–283). https://dare.uva.nl

Supplementary Materials

S1. The List of Considered Works Using Ascent of Humans

Download: https://collabra.scholasticahq.com/article/33297-ascent-of-humans-investigating-methodological-and-ethical-concerns-about-the-measurement/attachment/84708.docx?auth_token=CxKZL3LLQoufT42MuhaD

S2. The Illustration of the Bogus Scale (Evolution of Mobile Phones)

Download: https://collabra.scholasticahq.com/article/33297-ascent-of-humans-investigating-methodological-and-ethical-concerns-about-the-measurement/attachment/85022.jpg?auth_token=CxKZL3LLQoufT42MuhaD

Peer Review History

Download: https://collabra.scholasticahq.com/article/33297-ascent-of-humans-investigating-methodological-and-ethical-concerns-about-the-measurement/attachment/85023.docx?auth_token=CxKZL3LLQoufT42MuhaD

Artykuł 2 - Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic.

PLOS ONE

RESEARCH ARTICLE

Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic

Kamil Izydorczak[1]*, Karolina Antoniuk[1], Wojciech Kulesza[2], Paweł Muniak[2], Dariusz Dolinski[1]

1 Faculty of Psychology in Wroclaw, SWPS University of Social Sciences and Humanities, Wroclaw, Poland, **2** Warsaw Faculty, Centre for Research on Social Relations, SWPS University of Social Sciences and Humanities, Warsaw, Poland

* kizydorczak@swps.edu.pl

OPEN ACCESS

Citation: Izydorczak K, Antoniuk K, Kulesza W, Muniak P, Dolinski D (2022) Temporal aspects of unrealistic optimism and robustness of this bias: A longitudinal study in the context of the COVID-19 pandemic. PLoS ONE 17(12): e0278045. https://doi.org/10.1371/journal.pone.0278045

Editor: Maurizio Fiaschetti, UCL: University College London, UNITED KINGDOM

Received: February 21, 2022

Accepted: November 8, 2022

Published: December 15, 2022

Peer Review History: PLOS recognizes the benefits of transparency in the peer review process; therefore, we enable the publication of all of the content of peer review and author responses alongside final, published articles. The editorial history of this article is available here: https://doi.org/10.1371/journal.pone.0278045

Data Availability Statement: All data files are available from the Open Science Framework database (https://osf.io/4c3kr/?view_only=b8c01be2d17c4d8f892ba567b78d18f5).

Abstract

Numerous studies on unrealistic optimism (UO) have shown that people claim they are less exposed to COVID-19 infection than others. Yet, it has not been assessed if this bias evolves; does it escalate or diminish when the information about the threat changes? The present paper fills this gap. For 12 months 120 participants estimated their own and their peers' risk of COVID-19 infection. Results show that UO regarding COVID-19 infection is an enduring phenomenon–It was the dominant tendency throughout almost the entire study and was never substituted by Unrealistic Pessimism. While the presence of UO-bias was constant, its magnitude changed. We tested possible predictors of these changes: the daily new cases/deaths, the changes in governmental restrictions and the mobility of participants' community. Out of these predictors, only changes in governmental restrictions proved to be significant- when the restrictions tightened, UO increased.

Introduction

Numerous psychological studies have demonstrated that optimism is generally associated with better emotional, social, and task-related functioning. Optimism increases the chances of achieving success [1–3] and is associated with better physical health [4, 5].

Optimism can manifest itself in social comparisons [6]. Specifically, we may believe that fate is kinder to us than to others. In such a case, both positive and negative implications can be expected. This type of comparative optimism can help individuals to maintain a high level of well-being while also making them too carefree or reckless. This bias is referred to as unrealistic optimism (UO). In the current work, we present a study that is, to the best of our knowledge, the longest longitudinal study examining UO in the context of a real-world, enduring threat.

Unrealistic optimism bias

Neil Weinstein was a forerunner in demonstrating that "people believe that negative events are less likely to happen to them than to others, and they believe that positive events are more

Funding: This research was supported by grants: 1. RID (Regionalna Inicjatywa Doskonałości Mazowsza - Regional Excellence Initiative for Masovian District - https://www.gov.pl/web/edukacja-i-nauka/regionalna-inicjatywa-doskonalosci): "Unrealistic optimism in the age of pandemic. Health research and ensuring safety for the inhabitants of Mazovia district" granted to Dariusz Dolinski (number: 2020/2). 2. The Polish National Agency for Academic Exchange (NAWA - https://nawa.gov.pl/) within the Urgency Grants programme granted to Wojciech Kulesza (number: PPN/GIN/2020/1/00063/U/00001). 3. SWPS University of Social Sciences and Humanities - internal grant from FRBN programme (Fundusz Rozwoju Badań Naukowych - Research Development Fund) granted to Wojciech Kulesza (number: 41/2022/FRBN/E) The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

likely to happen to them than to others" [7]. Weinstein named this phenomenon "unrealistic optimism" (UO).

In their seminal article, Taylor and Brown [8] proposed treating UO as an instance of so-called positive illusions, the main purpose of which is to reduce stress and anxiety. From this perspective, one may conclude that UO helps people to cope with potentially threatening experiences.

Indeed, numerous studies have shown that unrealistic optimism appears in a range of contexts, some of which may pose a risk to individuals' wellbeing. For example, it has been found with respect to the probability of experiencing various diseases, such as alcoholism or heart attacks [9], breast cancer in women, and prostate cancer in men [10].

Unrealistic pessimism

Although people are usually unrealistically optimistic, this is not always the case. For example, Dolinski and colleagues [11] conducted a study on Polish students one week after the tragic accident at the Chernobyl nuclear power station, when the radioactive cloud had arrived over the territory of Poland.

The participants were asked about the probability of falling ill with radiation sickness, and they judged that they were more vulnerable to the sickness compared to other individuals. The researchers termed this effect unrealistic pessimism (UP). A similar effect was noted by Burger and Palmer [12] after the 1989 California earthquake.

Temporal aspects of unrealistic optimism/pessimism

Burger and Palmer [12] repeated their study three months later and discovered that the bias transitioned from UP to UO. Thus it seems that unrealistic pessimism is a short-term state.

Unrealistic pessimism can motivate an individual to take more preventive measures. In the Chernobyl study, unrealistic pessimists performed many more actions that could protect them from danger (for example, they tried not to leave the house and drank Lugol's liquid). However, since pessimism is associated with experiencing stress, anxiety, and a diminished sense of control, perhaps this state becomes too burdensome if it lasts too long. At some point, people may return to their initial belief that bad things will happen to other people rather than to them.

Another study, examining the temporal aspect of the UO bias, was conducted by Helweg-Larsen [13] in the context of the Northridge, California earthquake in 1994. In this longitudinal study, the author examined UCLA undergraduates one week after they experienced the earthquake and then in seven, consecutive waves during the following five months after the earthquake. Helweg-Larsen discovered that participants did not display an optimistic bias in respect to the earthquake and their realistic estimations persisted throughout the whole 5-month period. The author suggests that directly experiencing the disaster diminished individuals' sense of personal control over the particular event and therefore broke the illusion of invulnerability.

Of particular note, the participants displayed a UO bias in respect to other natural disasters (such as a flood) for the entire studied period. This fact might explain the difference in Burger and Palmers' results [12], because the authors of the earlier study did not ask questions about the earthquake specifically, but about 'natural disasters' in general.

Unrealistic optimism in the COVID-19 era

The COVID-19 pandemic is a phenomenon that affects whole societies and similarly to the abovementioned Chernobyl disaster and earthquake, it was unexpected and almost completely

uncontrollable [11, 12]. Recent studies conducted in various parts of the world have observed UO regarding the possibility of contracting the coronavirus (for instance, in Iran, Kazakhstan, and Poland [14], in Romania and Italy [15] and in the USA and UK [16]).

It is noteworthy that the dynamic of the COVID-19 pandemic is different from the aforementioned catastrophes. In the case of a nuclear power plant explosion or an earthquake, the real threat rapidly peaks and then diminishes. In the case of the coronavirus pandemic, the situation endures for months, and now years, with fluctuations in the level of threat. These fluctuations are signaled both by objective data (cases, deaths, etc.) and political decisions (lockdowns, border closures, etc.). The question is how these changes in the situation may affect the level of UO.

The goal of the study

Summing up, the present paper addressed three issues: (1) Is UO a robust phenomenon from a long-term perspective? (2) What is the relationship between changes in the level of danger and changes in bias? (3) What is the relationship between changes in the level of social isolation and changes in bias?

In detail, we were interested in whether UO disappears, turns into UP, or changes its magnitude. These changes may emerge when the media reports about the development of the pandemic and its severity, especially about increasing numbers of infected people and deaths from COVID-19.

People may also estimate the severity of the pandemic by observing the management of the pandemic by governmental bodies. Stricter restrictions (e.g., the introduction of lockdowns) may signal that "the situation is dangerous". Additionally, a liberalization of the rules of social coexistence (e.g., the opening of schools, shops, and restaurants, or by allowing fans to watch matches in stadiums) may signal that "it's safe".

Last but not least, Unrealistic Optimism may also be influenced by the cognitive availability of others' protective measures [17, 18]. If so, we might expect the magnitude of UO bias to change depending on how often we witness other people's behaviors. The bias could be stronger when we remain in household isolation, observing the behaviors of only a few close relatives and significant others.

General method

Participants

The study was conducted among Polish employees of an international corporation located in Wroclaw city (around 700,000 residents).

The sample consisted of 120 participants with university degrees (64 men and 56 women) aged 25–45 (M_{age} = 33.64, SD_{age} = 5.68) who agreed to answer a questionnaire. All participants worked in the same telecommunication company and on the same site for the whole period of the study. During most of the study, participants worked online. All participants held job positions related to computer programming.

The sample size was determined via feasibility criteria. The authors had to rely on the limited number of available participants, especially in the light of the rapidly evolving pandemic which forced the research team to organize the study as soon as possible. As a result, it was concluded that 120 participants in a one-condition, repeated-measures design was sufficient to detect meaningful effects. The results of the study were supplemented by a simulation-based power analysis [19]. The analysis indicated that assuming the obtained pattern of the means, the design of the study provided a power of 1-β = 1 for α = .05. The simulation also indicated

that n = 33 would be sufficient to detect main effects and n = 44 would be sufficient to detect interaction effects with a power of 1-β = .9 and α = .05.

All participants provided informed consent to participate in the study. Participation was fully voluntary, and participants did not obtain remuneration in any form. Since one of the authors was a contractor in the participants' workplace, high-quality data-gathering was ensured and all participants who entered the study participated in all of the waves (there were no dropouts). The study was reviewed and approved by the local [due to anonymity, further details to be provided] ethics committee (opinion number: 03/P/04/2020). Informed consent was obtained from all participants before enrollment in the procedure and data collection.

Procedure

All of the data were collected via an online survey. The database, along with the code for reproducible analyses and figures is publicly available on Open Science Framework (https://osf.io/4c3kr/https://osf.io/4c3kr/?view_only=b8c01be2d17c4d8f892ba567b78d18f5).

The data collection started when the first cases of COVID-19 were confirmed across many European countries, but before the first case was confirmed in the participants' country of residence. This first research wave (out of 16) was conducted on 03/01/2020. The second wave was conducted one day after the first confirmed case of COVID-19 infection in Poland on 03/04/2020. The third wave was conducted on 03/06/2020, 4 days after the WHO announced COVID-19's pandemic status.

The dates of the waves were chosen to coincide with the "milestones" of the pandemic (rapid increase/decrease in contractions or deaths). Data collection stopped exactly 12 months after the first measurement and—more importantly—when the COVID-19 vaccination for the general population became available in Poland.

Finally, 16 waves of data collection were conducted on the following dates: 03/01/2020; 03/04/2020; 03/16/2020; 04/23/2020; 05/26/2020; 06/16/2020; 06/19/2020; 08/07/2020; 09/17/2020; 10/07/2020; 10/15/2020; 12/06/2020; 01/05/2021; 01/27/2021; 02/16/2021; and 03/03/2021.

R programming language was used to prepare, analyze, and visualize the data [20], along with the "tidyverse" package [21] and "afex" package [22].

Risk and unrealistic optimism

In each wave, the participants were asked to answer two questions assessing the perceived risk of COVID-19 infection:

1. What is the probability that you will be infected with the novel coronavirus?
2. What is the probability that an average person of your age and gender will become infected with the novel coronavirus?

The respondents rated their answers on an 11-point scale (1 = Absolutely impossible; 11 = Absolutely certain).

These two questions served as a measure of the subjectively perceived risk of COVID-19 contraction for "Self" ($Risk_{Self}$) and "Others" ($Risk_{Others}$).

The measure of UO was obtained by subtracting the risk estimate for "Self" from the estimate for "Others". We called this measure "Comparative Index" ($C_{index} = Risk_{Others}—Risk_{Self}$). A positive score indicated that the person estimated their chances to be lower than others, therefore exhibiting UO. A negative score indicated that the person exhibited UP. A score of "0" would indicate a lack of both biases.

At the end of each round, participants were asked to provide their unique code consisting of the first letters of their parents' names and the number of their month of birth (e.g., TD07). This procedure enabled us to track the scores for the entire 12 months of the study.

Additionally, since vaccines against COVID-19 became available to the public, during the last two waves, the participants were asked about whether they were vaccinated (we observed that no participants were vaccinated) and whether they intended to get the shot when they become eligible for it. It turned out that 71.7% of the respondents were eager to get vaccinated as soon as vaccines became available for their demographic. Because of the lack of sufficient variance in the results, we decided not to analyze the relationships concerning vaccine-related variables.

Primary analysis

In the primary analysis, we aimed to examine the changing patterns of UO and how they might be related to the changes in objective data regarding the COVID-19 pandemic (the number of daily cases and deaths). The number of new COVID-19 cases and deaths was obtained from the "Our World in Data" website [23]. We considered the numbers for the entirety of Poland. This information is the most reliable and consistent and they are derived directly from official governmental announcements.

Three research questions were posed:

1. Will we observe a main effect of Unrealistic Optimism; specifically, will $Risk_{Others}$ be higher than $Risk_{Self}$?
2. Will we observe a main effect of the waves? Will the $Risk_{Self}$ and $Risk_{Others}$ estimates change in accordance with the waves?
3. Will we observe a relationship between objective data (daily infections and daily deaths from COVID-19) and the estimations of risk and UO ($Risk_{Self,}$ $Risk_{Others,}$ and C_{index}).

Results

Before addressing our research questions, we visually analyzed the distribution of the variables to detect possible outliers and to obtain an understanding of the data structure. After inspecting the box plots for $Risk_{Self}$ and $Risk_{Others}$ in all 16 waves, we concluded that (except for the first wave) there were no influential outliers. For that reason, we assumed that the differences between the means reflected the differences in the central tendencies and we performed no outlier deletion.

While visually inspecting the histograms for $Risk_{Self}$ and $Risk_{Others}$, we concluded that the distributions significantly differed from normal, forming either right-skewed or uniform shapes.

Upon inspecting the "Daily new cases" and "Daily deaths" variables, we discovered that the distribution was exponential in shape, which is a pattern that was expected in the case of the rising pandemic.

$Risk_{Self}$ and $Risk_{Others}$ vs. waves. To determine whether the risk estimates for "Self" and "Others" varied across waves, we conducted a 2 ("Self" *vs*. "Others") * 16 ("Waves") two-way, between-subject ANOVA with "Risk" as a dependent variable.

We found a strong main effect of UO ($F[1, 119] = 101.41$, $p < .001$, $\eta_p^2 = .46$). The average estimate of "risk" for "self" was significantly lower ($M_{risk\_self} = 4.77$, $SD_{risk\_self} = 3.33$) than for "others" ($M_{risk\_others} = 6.18$, $SD_{Risk\_others} = 3.15$) meaning that there was a main tendency for estimating own risk as lower than others' risk (UO).

Similarly, waves proved to differentiate the estimates of "Risk" (F[5.10, 606.32] = 52.06, $p <$ .001, η_p^2 = .3). The lowest estimates were observed in the first wave (01.03.20) (M_{risk_1} = 1.76, SD_{risk_1} = 1.14). The highest "risk" estimates were observed in the fifth wave (26.05.20) (M_{risk_5} = 7.10, SD_{risk_5} = 2.98), meaning that just before the first case of COVID-19 was reported (first wave), the risk estimates were lowest and were close to the "Absolutely impossible" point. The highest perceived threat was noted approximately three months after the first COVID-19 case in Poland.

The interaction between "Self/Others" estimates and "Waves" also proved to be significant (F[7.39, 879.18] = 10.92, $p <$ .001, η_p^2 = .08). To investigate this interaction, a contrast analysis was performed.

We tested estimates of risk for "Self" and "Others" pairwise in each of the 16 waves. UO (indicated by significantly higher risk estimates for "Others" than "Self") was found in all of the waves except for the first, fourth, and fifth. It should be noted that these waves were associated with either the lowest estimates of risk (Wave 1) or the highest estimates of risk (Wave 4 or Wave 5). Additional support for the nearly constant presence of UO is the proportion of responses indicating comparative optimism ($C_{index}>0$) and comparative pessimism ($C_{ndex}<0$). In all waves, par the aforementioned 1, 4 and 5, there were more comparative optimists than pessimists. In the last wave, this advantage was the biggest: 50.83% of responses indicated comparative optimism ($C_{index} > 0$) while only 6.67% indicated comparative pessimism ($C_{index} < 0$). The average composition of responses for all 16 waves was: comparative optimism ($C_{index} > 0$) = 36.46%, comparative pessimism ($C_{index} < 0$) = 13.07% and unbiased ($C_{index} = 0$) = 50.47%. See detailed results for all waves in the Supporting Information section and in the online repository (https://osf.io/4c3kr/).

In summary, the UO effect was present during the entire first year of the pandemic, except for brief periods when the estimates of risk were the most extreme (see the detailed table of contrast effects in the Supporting Information section or in the OSF repository: https://osf.io/4c3kr/https://osf.io/4c3kr/?view_only=b8c01be2d17c4d8f892ba567b78d18f5).

Additionally, we decided to investigate the presence of time trends in $Risk_{Self}$, and $Risk_{Others}$ using autocorrelation tests. This method is advisable when we want to detect whether there is a consistent (stable or seasonal) pattern in our longitudinal variable or if we are observing random changes [24]. We used the 'ACF' function from '*nlme*' package [25] (Pinheiro et al., 2022) in the R programming language [20]. See Fig 1 for a visualization of the autocorrelation patterns.

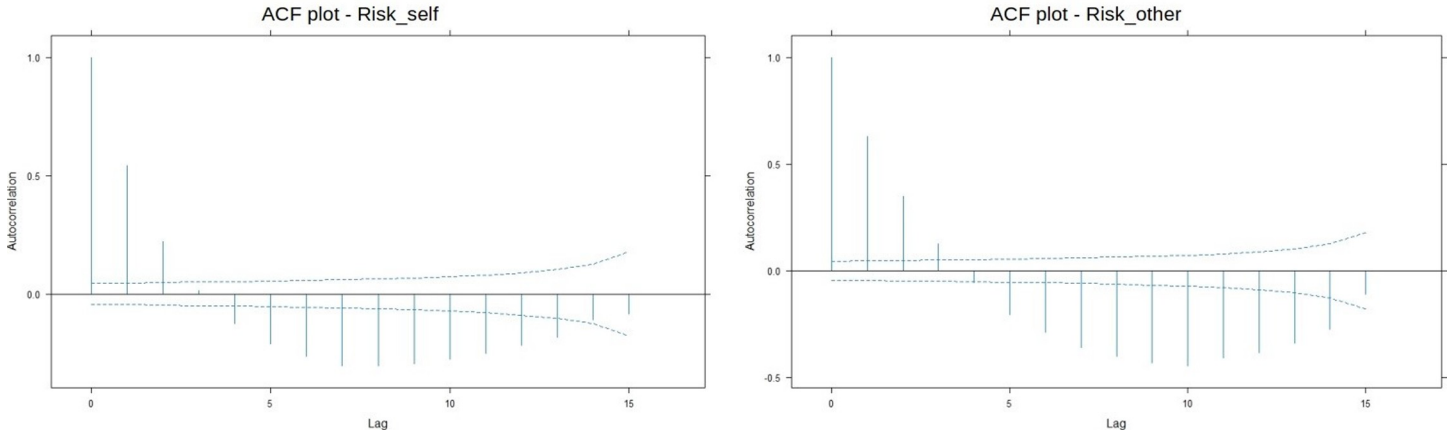


Fig 1. ACF plot for $Risk_{Self}$ and $Risk_{Others}$. The blue line represents the cutoff points for correlations that are significant at p = .05.

https://doi.org/10.1371/journal.pone.0278045.g001

In the graph we can observe that nearly every time point correlates with the previous ones, which indicates a strongly pronounced time-trend with little to no randomness in the pattern. The pattern signals a possible seasonality in the changes in risk estimates.

Daily cases and daily deaths vs. $Risk_{Self}$, $Risk_{Others}$ and C_{index}. To test whether the risk estimates and C_{index} correlated with daily cases and daily deaths, we performed Kendall's tau tests. The results are presented in Table 1.

All the correlations were significant, and their directions indicated the positive relationship of risk estimates with daily cases and daily deaths; however, the relationships were weak. If not for the relatively large sample of observations, these correlations would not be substantially different from "0", and it is hard to acknowledge their practical or theoretical significance.

However, upon inspecting the visualized data regarding the relationship between risk estimates and daily cases/deaths, we observed a pattern of nonlinear relationships. The pattern became especially clear when cases and deaths were transformed to the logarithmic scale (and such a transformation is advisable for exponential distributions). See Figs 2 and 3 for details.

For both cases and deaths, the risk estimates initially increased. However, there was a "breaking point" at which the estimates for "risk" began to decrease with each higher order of magnitude of cases and deaths.

In the relationship between the C_{index} and daily cases and deaths, we identified no such pattern—the C_{index} fluctuated erratically as the number of cases and deaths increased (see the Supporting Information section or the OSF repository for visualizations: https://osf.io/4c3kr/?view_only=b8c01be2d17c4d8f892ba567b78d18f5https://osf.io/4c3kr/).

Secondary analysis

While answering the first two research questions, we established that the magnitude of UO varied with the waves of the studies. Although UO was almost always present and was never substituted with UP, it was stronger during certain waves and weaker during other waves.

While addressing the third question, we established that changes in daily cases and deaths were not sufficient to explain the differences in the magnitude of UO.

According to the motivational explanations of Unrealistic Optimism, people exhibit it, because it helps them to cope with an ongoing or predicted threat [17, 18]. Our results suggest that there is almost no relation between the objective level of threat and UO, which casts doubt on the motivational roots of UO during the COVID-19 pandemic.

However, objective measures such as official statistics may not be the only or the most important source of information from which people may infer the level of threat. We concluded that another such source may be the strictness of COVID-19 preventative policies. First, this is because changes in these policies noticeably affected the lives of individuals and second, due to intensive information campaigns, they were salient,.

Table 1. Correlation coefficients (r_τ) between COVID-19 daily cases/deaths, risk estimates for "Self" and "Others", and intensity of UO.

n = 1920	Daily cases	Daily deaths
$Risk_{Self}$	$r_\tau = .04$, $p = .023^{*}$	$r_\tau = .04$, $p < .014^{*}$
$Risk_{others}$	$r_\tau = .11$, $p < .001^{***}$	$r_\tau = .08$, $p < .001^{***}$
C_{index}	$r_\tau = .10$, $p < .001^{***}$	$r_\tau = .07$, $p < .001^{***}$

*—significant at $p < .05$,

***—significant at $p < .001$

https://doi.org/10.1371/journal.pone.0278045.t001

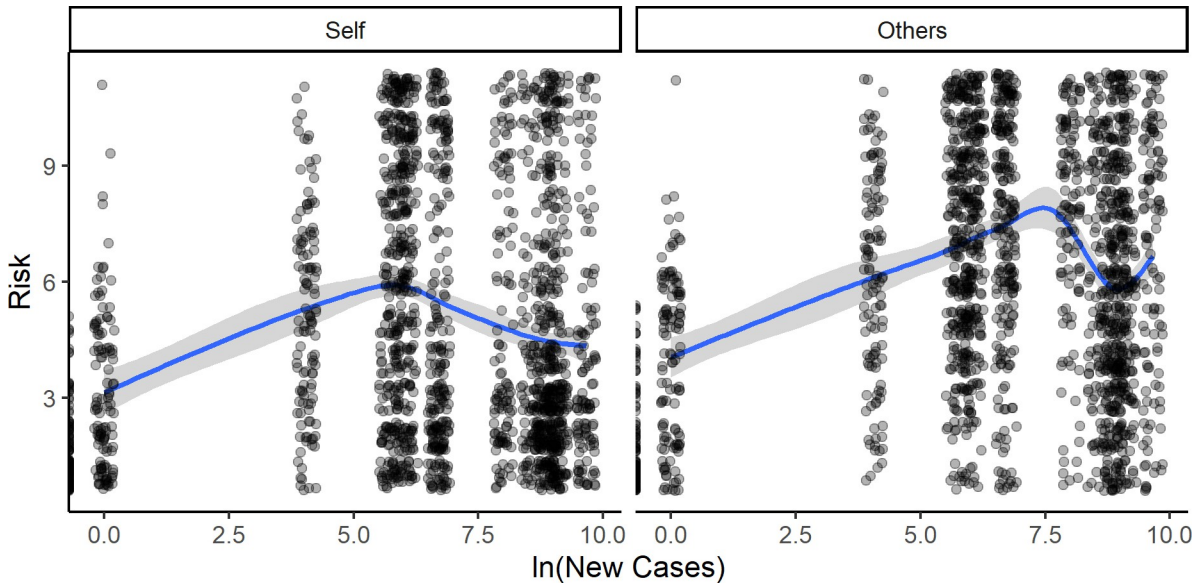


Fig 2. Natural logarithm of daily new cases vs. $Risk_{Others}$ (left panel) and $Risk_{Self}$ (right panel)—Visualization of locally weighted regression ('loess').

https://doi.org/10.1371/journal.pone.0278045.g002

Assuming the motivational explanation of UO, we should expect UO levels to be higher when the restriction policies are stricter because they signal a stronger threat. To test this prediction, we computed a "Restrictions" variable, which captures the changes in governmental, anti-COVID policies.

Another possible time-varying factor that could influence the UO bias is the intensity of direct, social contacts. During the first year of the pandemic, people experienced different levels of social isolation–partly due to their own decisions and partly because of the changing

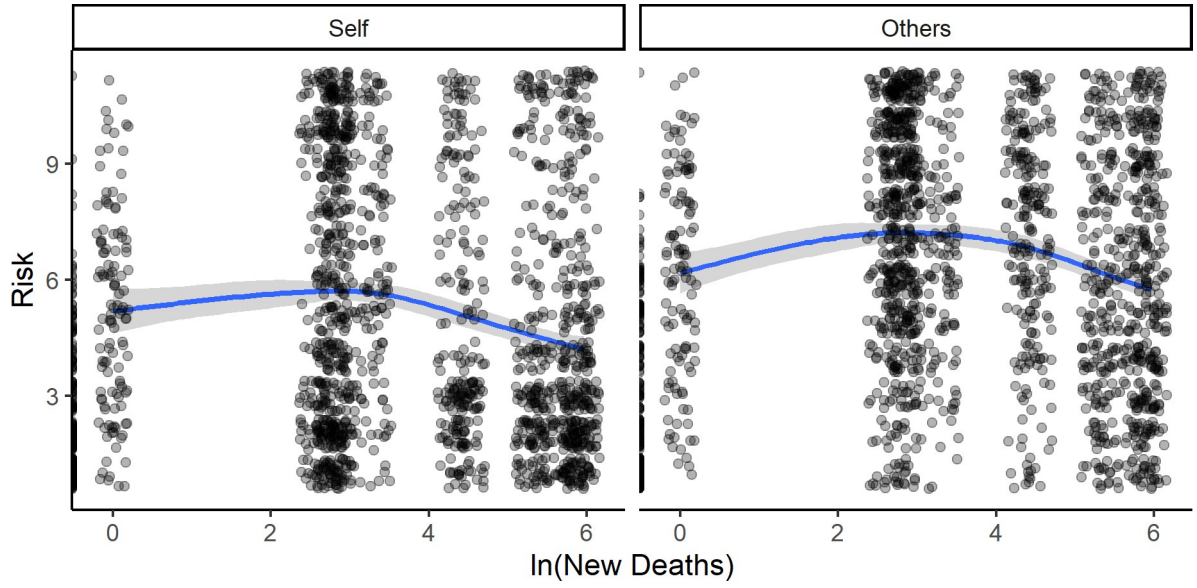


Fig 3. Natural logarithm of daily new deaths vs. $Risk_{Others}$ (left panel) and $Risk_{Self}$ (right panel)—Visualization of locally weighted regression ('loess').

https://doi.org/10.1371/journal.pone.0278045.g003

laws and remote-work policies of their workplace. In line with the cognitive explanation for Unrealistic Optimism, people display it mostly due to asymmetry in cognitive perspectives–they are more aware of their own preventive measures than those of others and for that reason, they see themselves as less at risk [17, 18].

Assuming this explanation, communities should exhibit more Unrealistic Optimism when their members spend more time in their homes. With less direct contact with other people, the cognitive asymmetry should be further reinforced. To test this prediction we used data from Google Mobility Trends [26], which capture the changes in the time spent at home by communities in a given area.

Restrictions

"Restrictions" was embedded in the timeline after data collection and it was a dichotomous variable reflecting the government policy at a given time in participants' residential area. "Restrictions" could exhibit two values: "easing" and "tightening".

We defined the "tightening" period as a time in which government officials announced new COVID-19 prevention restrictions. Usually, the announcements were made a few days ahead of enforcement (e.g., 10.03.2020 –ban on mass events, 31.03.2020 –introducing limits for customers in shops).

We defined the "easing" period as a time in which government officials announced and implemented laws that lifted some of the previous COVID-19-prevention restrictions. (e.g., 20.04.2020 –lifting the ban on recreational mobility and using public green spaces, 04.05.2020 –reopening of shopping malls).

The first wave of studies (01.03.2020) was left uncategorized, because at the time, there were no COVID-19 cases in Poland, no salient restrictions, and no clear message from the authorities.

This message suddenly changed upon the diagnosis of the first COVID-19 case (04.03.2020); thus, the second wave was classified as "tightening".

It is worth noting that in both the "easing" and "tightening" periods, the government decisions escalated: after the first "easing"/"tightening" announcement, typically another one occurred. Each period resulted in a reversal of the trend.

The details of the policies and rationale for coding the "easing" and "tightening" periods can be found in the Supporting Information section and the OSF repository (https://osf.io/4c3kr/)

We assumed that the "tightening" communication would send the general public a message that "the situation is serious" and "there is something to worry about". Assuming that UO is a means to cope with stressful events [27–29], we predicted that when restrictions were tightened, UO should be higher.

Analogously, we supposed that in the "easing" period, officials sent a comforting message: "things are getting better" and "you don't have to worry as much as you did". During one of the "easing" periods, the Prime Minister of Poland stated explicitly: "I am glad that we are less and less afraid of this virus. It is a good approach because it [COVID-19] is on the retreat" (01.07.2020).

Social isolation in the community: Google mobility trends

To quantify the degree of social isolation in the community in which participants lived, we acquired the Google Mobility Trend score for Wroclaw County, Poland (the residential area of our respondents) during the days in which we conducted our waves of measurement.

We used the "Residential" score category, which calculates the change in the time spent at home among a given population [26]. The "Residential" score is calculated as the percentage change in time spent at home, using the first week of February 2020 as the baseline. The score for each day of the week is calculated based on the baseline value for that day of the week from 1–8 February 2020. In the first week of February 2020, there were no cases of COVID-19 in Poland and no regulations affecting citizens' everyday activity and mobility.

The Google mobility "Residential" score is a measure of overall time spent outside the household by members of the community from a given area. It is based on data provided by smartphones using Google software. Given that 78% of citizens in Poland are smartphone users and almost 90% of these users use the Android system, the score can be a good representation of actual mobility [30]. This might be especially true in highly urbanized areas, such as Wrocław, which has many students and white-collar workers as residents.

It is important to note that the Google Mobility Trends score does not directly relate to the behavior of our participants, but rather to their environment as a whole. On days when the "Residential" score was lower, the time spent outside the household within the whole community was longer. It means that participants were more likely to visit public places, and they were more likely to observe more people in these spaces. This feature makes the Google Mobility Trends score a particularly appropriate variable for measuring the overall intensity of face-to-face, social interactions. For the purpose of our hypothesis, we were looking for a measure that corresponds with the chances of directly observing other people's behaviors—we believe that the Google Mobility "Residential" score serves this goal well because it corresponds with the number of people "on the streets" at a given time.

Restrictions vs. $Risk_{Self}$, $Risk_{Others}$ and C_{index}

To test whether changes in "Restrictions" could explain changes in absolute and relative estimations of COVID-19 infection risk, we conducted linear mixed-model analyses with "Restrictions" ("Easing" *vs*. "Tightening") as a fixed effect variable, individuals' ID as a random grouping factor and $Risk_{Self,}$ $Risk_{Others}$, and C_{index} as dependent variables. In each analysis, we used Type-III sum of squares and model terms were tested with likelihood-ratio tests. In each analysis, we allowed the slopes to vary by the "ID". Models were fitted with the ML method.

In addition to testing the fit, we also compared the "Restrictions" fixed effect models to models with "Waves" fixed effects, to establish whether "Restrictions" provide a better fit for the model than the "Waves" themselves. AIC and BIC were used to compare the models. JASP ver. 0.16.0 [31] was used in the calculations and visualization. The reproducible analysis can be found in the OSF repository (https://osf.io/4c3kr/)

"Restrictions" proved to be a significant predictor for $Risk_{Self,}$ ($\chi^2[2] = 42.27$, $p < .001$). The estimate marginal means for $Risk_{Self}$ were higher for the "easing" ($M_{easing} = 5.60$, $SE_{easing} = 0.19$) than for the "tightening" condition ($M_{tight.} = 4.56$, $SE_{ight,} = 0.19$). The fit statistics for the model were: $AIC = 9013.69$ and $BIC = 9046.66$ and were higher than those for the analogical model with "waves" fixed effects ($AIC = 9470.05$, $BIC = 9507.13$).

To summarize, "Restrictions" proved to predict $Risk_{Self}$ with a better fit than "waves"; when restrictions were tighter, the risk estimates for "Self" decreased. See Table 2 for detailed results of the analysis.

"Restrictions" proved to be a significant predictor for $Risk_{Others}$ as well, although the effect was weaker ($\chi^2[2] = 8.77$, $p < .001$). The estimate marginal means for $Risk_{Others}$ were higher for the "easing" ($M_{easing} = 6.67$, $SE_{easing} = 0.19$) than for the "tightening" period ($M_{tight.} = 6.33$, $SE_{ight,} = 0.18$. The fit statistics for the model were: $AIC = 8556.04$ and $BIC = 8589.01$ and were higher than those for the "waves" fixed effect model ($AIC = 8755.67$, $BIC = 8855.75$).

Table 2. Summary of linear mixed-models with $Risk_{Self}$, $Risk_{Others}$ and C_{index} as dependant variables, "Restrictions" as a fixed effect and "ID" as a random effect.

Dependent variable	Estimates for "Restrictions"	Mean "Easing"	Mean "Tightening"
$Risk_{Self}$	Intercept = 5.08, *SE* = 0.17	***M* = 5.60**,	$M_{.}$ = 4.56,
	b = 0.52***, *SE* = 0.07, *df* = 119.99	95% *CI* [5.22, 5.97]	95% *CI* [4.19, 4.93]
$Risk_{others}$	Intercept = 6.50, *SE* = 0.18	***M* = 6.67**,	$M_{.}$ = 6.33,
	b = 0.17***, *SE* = 0.06, *df* = 1679.45	95% *CI* [6.3, 7.04]	95% *CI* [5.97, 6.68]
C_{index}	Intercept = 1.42, *SE* = 0.14	*M* = 1.07,	**$M_{.}$ = 1.76**,
	b = -0.35***, *SE* = 0.07, *df* = 120	95% *CI* [0.78, 1,37]	95% *CI* [1.43, 2.10]

***—significant at $p < .001$, **bold** indicates higher mean value row wise.

https://doi.org/10.1371/journal.pone.0278045.t002

Analogous to $Risk_{Self}$, "Restrictions" proved to predict $Risk_{Others}$ with a better fit than "waves" and the risk estimates for "Others" decreased when restrictions were tightened. See Table 2 for detailed results of the analysis and see Fig 4 for the visualizations of the changes in risk estimates over time as well as in different restriction periods.

Finally, we tested whether "Restrictions" can predict the $C_{index,}$ which is our measurement of the magnitude of UO bias. "Restrictions" proved to be a significant predictor ($\chi^2[2] = 20.29$, $p < .001$). The estimated marginal means for C_{index} were lower for the "easing" ($M_{easing} = 1.07$, $SE_{easing} = 0.15$) than for the "tightening" period ($M_{tight.} = 1.76$, $SE_{ight,} = 0.17$). The fit statistics for the model were: *AIC* = 9015.28 and *BIC* = 9048.26 and were higher than those for the "waves" fixed effect model (*AIC* = 9448.89, *BIC* = 9548.97).

UO bias proved to be stronger in the "tightening" conditions and once again "restrictions" proved to be a valuable explanatory variable, providing a predictive model with a better fit than the plain repeated measures variable ("Waves"). See Fig 5 for visualization of the UO bias changes along with the waves and different "Restrictions" periods.

Social isolation vs. $Risk_{Self}$, $Risk_{Others}$ and C_{index}

To test whether changes in "Residence Mobility" could explain changes in absolute and relative estimations of COVID-19 infection risk, we used an analogical, linear mixed-model strategy.

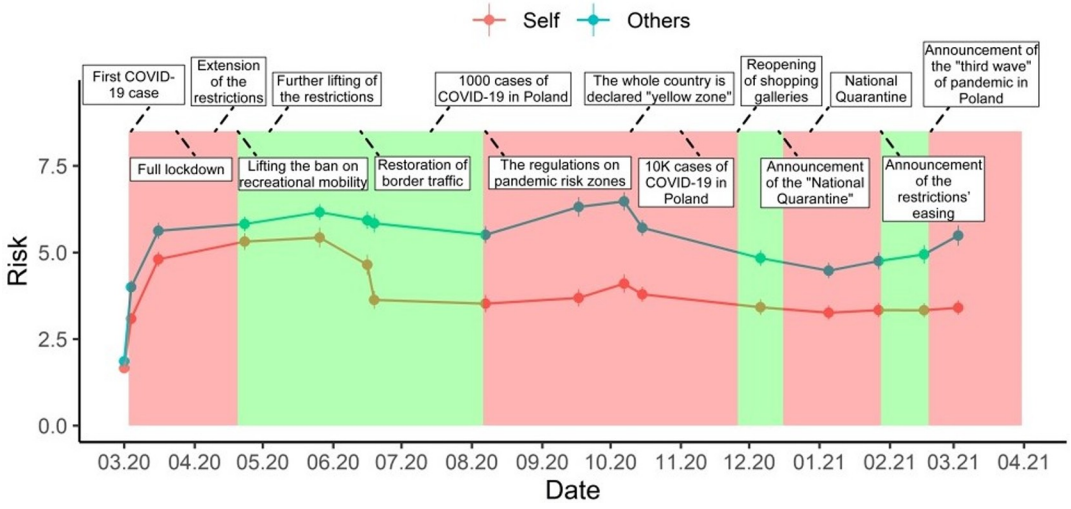


Fig 4. Line plot of changes in risk estimates over time. Each dot represents mean risk estimates for "Self" (blue) and "Other" (red) at a given time. Bars represent standard errors of means. Frames above the graph describe the most important events in the timeline of the pandemic.

https://doi.org/10.1371/journal.pone.0278045.g004

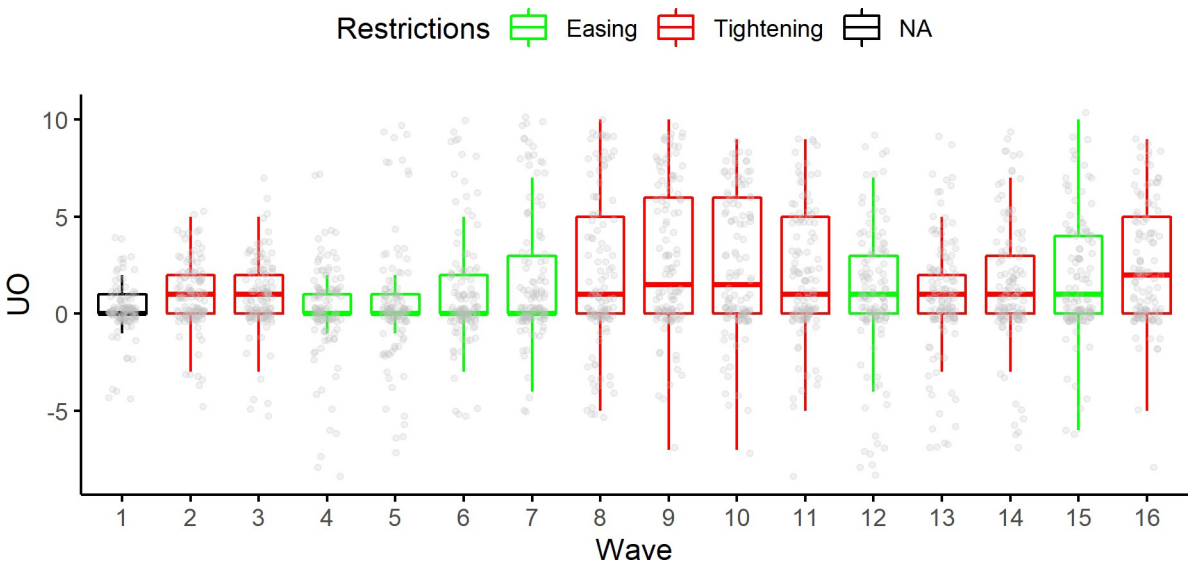


Fig 5. Box-plot of C_{index} distribution in all waves. Jittered points represent the density of C_{index} values. The color of the boxes represents the "Restriction" period in which the wave took place.

https://doi.org/10.1371/journal.pone.0278045.g005

We included the "Residence" mobility score as a fixed effect variable, individuals' ID as a random grouping factor and $Risk_{Self,}$ $Risk_{Others}$, and C_{index} as dependent variables. In each analysis, we used Type-III sum of squares and model terms were tested with Satterthwaite approximation. In each analysis, we allowed slopes to vary by the "ID" variable. Models were fitted using REML.

"Residence Mobility" proved to be a significant predictor for $Risk_{Self,}$ (F [1, 1752.43] = 106.98, $p < .001$). The model indicates that higher "Residential Mobility" scores predict higher $Risk_{Self}$ estimations ($b = 0.10$, SE < 0.01, $t = 10.34$, p < .001), which means that the more time the community spent at home, the higher the $Risk_{Self}$ estimates of our participants.

"Residence Mobility" proved to be a significant predictor for $Risk_{Others}$ as well, (F [1, 906.76] = 86.30, $p < .001$). The model indicates that higher "Residential Mobility" scores predict higher $Risk_{Others}$ estimations ($b = 0.08$, SE < 0.01, $t = 9.26$, p < .001), which means that the more time the community spent at home, the higher the $Risk_{Others}$ estimates of our participants.

Finally, we tested whether "Residence Mobility" predicts the magnitude of the UO bias. Assuming the cognitive explanation for UO, higher "Residential Mobility" scores should predict a higher C_{index}. However, it turned out that this relation is statistically non-significant (F [1, 453.74] = 2.47, $p = .12$).

To summarize, when the amount of time spent at home rises within a community, the risk estimations made by the members of this community increase. This is true for both "Self" and "Others" estimations. However, "Residential Mobility" does not appear to be related to the magnitude of the UO bias.

Discussion

We inspected two sources of information about the severity of the COVID-19 pandemic. The first source was objective data—the number of daily cases and deaths. The second source was governmental restrictions. While the numbers are abstract and difficult to interpret, restrictions are experienced directly and had a salient impact on the participants' lives.

We noted that the strength of the optimistic bias was almost independent of both the number of cases and deaths, however, the strength of unrealistic optimism did vary in accordance with the changes in policies by the state authorities.

When restrictions tightened, UO increased. The increase in UO took place mostly due the decrease in risk estimations for "Self". The estimates for "Others" also decreased during the "tightening" periods, but to a lesser degree.

Furthermore, we observed that although the degree of social isolation predicted both the risk estimates for "Self" and "Others" (the more contact, the less perceived risk), we did not find evidence for a relationship between social isolation and UO.

In light of the motivational explanation, UO is displayed during the COVID-19 pandemic because it is an extremely stressful situation and the more threat people experience, the stronger their UO bias.

The cognitive explanation for the UO suggests that people display UO because they are more aware of and are more concentrated on their own efforts to prevent COVID-19. The efforts of others are much less accessible.

Our study provides mixed support for both explanations. The purely motivational explanation is undermined by the lack of evidence for the relationship between UO and daily cases/deaths, which are a clear indication of the threat level. On the other hand, the purely cognitive explanation is also less plausible, considering the lack of evidence for a relationship between UO and social isolation.

The one factor that predicted the magnitude of UO was governmental restrictions and this factor can be interpreted in the light of both cognitive and motivational explanations. In fact, it can contain the elements of both mechanisms. On the one hand, the governmental restrictions can form stronger cues for threat than the objective numbers, affecting motivational mechanisms. On the other hand, in times of stronger restrictions, people were forced to take many additional, preventive measures, which required conscious effort and attention–this could reinforce the cognitive basis of the UO.

Our data should best be interpreted in conjunction with other studies conducted in the context of the COVID-19 pandemic. Correlational studies from multiple countries found a positive relationship between the gravity of the pandemic situation and the magnitude of UO [32], which supports a motivational explanation. On the other hand, a recent study by Vieites and colleagues [33] demonstrated experimentally that the cognitive availability of one's protective behaviors enhanced UO in the context of the COVID-19 pandemic, which provides support for a cognitive explanation.

It is worth noting that, as a general conclusion of our studies, the UO remained a dominant tendency throughout the whole first year of the pandemic. Contrary to the Burger and Palmer study [12], the bias was not present before the event was directly experienced (first wave) and contrary to Helweg-Larsen's study [13], it persisted even when the pandemic started to affect the studied population.

In comparison to natural disasters such as earthquakes, the COVID-19 pandemic is more pervasive and less directly experienced (while every human in the area feels the physical sensation of the earthquake, not everyone becomes infected with the virus and the virus itself is not visible with the naked eye). For that reason, the patterns of UO during the COVID-19 pandemic might differ significantly from patterns discovered in other contexts.

Limitations and directions for future research

While the longitudinal design provides unique insights, it also comes with limitations. First, in longitudinal studies, it is impossible to account for every event in the lives of individuals,

which may have a significant influence on the results. We can assume that general patterns of results may remain unaffected (which is supported by the lack of outliers), but some experiences, such as illness or the death of relatives/acquaintances, might be shared by many participants at the same time.

Second, our explanation of the differences in the level of UO was focused on three time-varying factors and we cannot exclude that other longitudinal processes could influence UO. One such example is political events during the first year of the pandemic–in that particular year, the citizens of Poland took part in national parliamentary elections that were accompanied by various controversial decisions and organizational difficulties.

The third important limitation is the composition of our sample. It mainly consisted of young adults with higher education who worked in the same company. While such a sample is still more diverse in terms of age and gender than standard student-only compositions, it is worth noting that the scope of the generalization of our study could be limited. Moreover, the homogeneity of our sample might have a significant impact on the baseline level of their unrealistic optimism. It has been shown that lower age and higher education are associated with higher unrealistic optimism [34]. Judging by the aforementioned research, we could expect that our sample might have higher levels of unrealistic optimism and lower levels of unrealistic pessimism than the general population. Future studies might replicate our research while—at the same time—employing more demographic/medical data about the participants to assess possible important factors that might influence the pattern of results.

The last limitation concerns the score of Google Residential Mobility Trends. We acknowledge that this measure is an indirect indicator of the number of observed individuals and might not necessarily reflect the local phenomena, such as the number of interpersonal contacts in particular neighborhoods or stores. Moreover, it does not account for the observation of others' behavior via traditional media and social media.

The two proposed mechanisms (the increase in threat, followed by the intensification of coping, and the increase in cognitive accessibility asymmetries) are not mutually exclusive. They may also co-occur or even reinforce one another. Moreover, during a time of increased threat, the ego-serving potential of asymmetric cognitive accessibility may help in coping with a stressful environment. Future research should aim to clarify this issue—and more importantly—replicate our results under different threats (not COVID-19 related).

It would also be interesting to verify the dynamics of unrealistic optimism in other contexts; for example, in regards to a serious illness that has phases of improvement and deterioration regarding the patient's condition or during prolonged attempts by a woman to become pregnant. It would also be particularly important to investigate how the rise and fall of unrealistic optimism are related to people's different decisions.

Another fruitful direction for future research could be investigating possible interactions between ecological and internal factors in longitudinal settings. For example, it has been proved that the magnitude of unrealistic pessimism with respect to the risk of breast cancer is higher for women with more comorbidities [34].

If we could track risk-related changes in the environment along with changes in infra-personal factors (such as health status), we may be able to understand the mechanism and limitations of the relationships between UO and external circumstances.

Supporting information

S1 Table. Frequency of comparative optimism/pessimism/unbiased across waves.
(DOCX)

S2 Table. Contrast effects for ANOVA—RiskSelf and RiskOthers vs. waves.
(DOCX)

S1 Fig. Visualization of locally weighted regression ('loess'): Daily new cases vs. C_index.
(TIF)

S2 Fig. Visualization of locally weighted regression ('loess'): Daily new deaths vs. C_index.
(TIF)

S3 Fig. Timeline of the study.
(PNG)

S1 File. Calendar of restrictions.
(XLSX)

Author Contributions

Conceptualization: Kamil Izydorczak, Karolina Antoniuk, Dariusz Dolinski.

Formal analysis: Kamil Izydorczak, Karolina Antoniuk.

Funding acquisition: Wojciech Kulesza, Dariusz Dolinski.

Investigation: Kamil Izydorczak, Karolina Antoniuk.

Methodology: Dariusz Dolinski.

Project administration: Karolina Antoniuk.

Supervision: Wojciech Kulesza, Dariusz Dolinski.

Validation: Paweł Muniak.

Visualization: Kamil Izydorczak.

Writing – original draft: Kamil Izydorczak.

Writing – review & editing: Wojciech Kulesza, Paweł Muniak, Dariusz Dolinski.

References

1. Lee LO, James P, Zevon ES, Kim ES, Trudel-Fitzgerald C, Spiro A, et al. Optimism is associated with exceptional longevity in 2 epidemiologic cohorts of men and women. Proc Natl Acad Sci U S A. 2019; 116: 18357–18362. https://doi.org/10.1073/pnas.1900712116 PMID: 31451635
2. Matlin MW, Stang DJ. The Pollyanna principle: selectivity in language, memory, and thought. Cambridge, Mass: Schenkman Pub. Co; 1978.
3. Seligman MEP. Authentic happiness: Using the new positive psychology to realize your potential for lasting fulfillment. New York, NY, US: Free Press; 2002.
4. Robbins AS, Spence JT, Clark H. Psychological determinants of health and performance: The tangled web of desirable and undesirable characteristics. J Pers Soc Psychol. 1991; 61: 755–765. https://doi.org/10.1037//0022-3514.61.5.755 PMID: 1753330
5. Scheier MF, Carver CS. Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. Health Psychol. 1985; 4: 219–247. https://doi.org/10.1037//0278-6133.4.3.219 PMID: 4029106
6. Shepperd JA, Waters E, Weinstein ND, Klein WMP. A Primer on Unrealistic Optimism. Curr Dir Psychol Sci. 2015; 24: 232–237. https://doi.org/10.1177/0963721414568341 PMID: 26089606
7. Weinstein ND. Unrealistic optimism about future life events. J Pers Soc Psychol. 1980; 39: 806–820. https://doi.org/10.1037/0022-3514.39.5.806
8. Taylor SE, Brown JD. Illusion and well-being: A social psychological perspective on mental health. Psychol Bull. 1988; 103: 193–210. https://doi.org/10.1037/0033-2909.103.2.193 PMID: 3283814

9. Weinstein ND. Reducing unrealistic optimism about illness susceptibility. Health Psychol. 1983; 2: 11–20. https://doi.org/10.1037/0278-6133.2.1.11
10. Clarke VA, Lovegrove H, Williams A, Machperson M. Unrealistic Optimism and the Health Belief Model. J Behav Med. 2000; 23: 367–376. https://doi.org/10.1023/a:1005500917875 PMID: 10984865
11. Dolinski D, Gromski W, Zawisza E. Unrealistic Pessimism. J Soc Psychol. 1987; 127: 511–516. https://doi.org/10.1080/00224545.1987.9713735
12. Burger JM, Palmer ML. Changes in and Generalization of Unrealistic Optimism Following Experiences with Stressful Events: Reactions to the 1989 California Earthquake. Pers Soc Psychol Bull. 1992; 18: 39–43. https://doi.org/10.1177/0146167292181006
13. Helweg-Larsen M. (The Lack of) Optimistic Biases in Response to the 1994 Northridge Earthquake: The Role of Personal Experience. Basic Appl Soc Psych. 1999; 21: 119–129. https://doi.org/10.1207/S15324834BA210204
14. Kulesza W, Doliński D, Muniak P, Derakhshan A, Rizulla A, Banach M. We are infected with the new, mutated virus UO-COVID-19. Arch Med Sci. 2020 [cited 25 Oct 2021]. https://doi.org/10.5114/aoms.2020.99592 PMID: 34900052
15. Druică E, Musso F, Ianole-Călin R. Optimism Bias during the Covid-19 Pandemic: Empirical Evidence from Romania and Italy. Games. 2020; 11: 39. https://doi.org/10.3390/g11030039
16. Salgado S, Berntsen D. "It Won't Happen to Us": Unrealistic Optimism Affects COVID-19 Risk Assessments and Attitudes Regarding Protective Behaviour. J Appl Res Mem Cogn. 2021; 10: 368–380. https://doi.org/10.1016/j.jarmac.2021.07.006 PMID: 34307004
17. Armor DA, Taylor SE. Situated Optimism: Specific Outcome Expectancies and Self-Regulation. In: Zanna MP, editor. Advances in Experimental Social Psychology. Academic Press; 1998. pp. 309–379. https://doi.org/10.1016/S0065-2601(08)60386-X
18. Shepperd JA, Carroll P, Grace J, Terry M. Exploring the Causes of Comparative Optimism. Psychol Belg. 2002; 42: 65–98. https://doi.org/10.5334/pb.986
19. Lakens D, Caldwell AR. Simulation-Based Power Analysis for Factorial Analysis of Variance Designs. Adv Methods Pract Psychol Sci. 2021; 4: 2515245920951503. https://doi.org/10.1177/2515245920951503
20. R Core Team. R: A Language and Environment for Statistical Computing. Vienna, Austria: R Foundation for Statistical Computing; 2021. Available: https://www.R-project.org/.
21. Wickham H, Averick M, Bryan J, Chang W, McGowan LD, François R, et al. Welcome to the tidyverse. J Open Source Softw. 2019; 4: 1686. https://doi.org/10.21105/joss.01686
22. Singmann H, Bolker B, Westfall J, Aust F, Ben-Shachar MS. afex: Analysis of Factorial Experiments. 2021. Available: https://CRAN.R-project.org/package=afex.
23. Ritchie H, Mathieu E, Rodés-Guirao L, Appel C, Giattino C, Ortiz-Ospina E, et al. Coronavirus pandemic (COVID-19). In: Our world in data [Internet]. 2020. Available: https://ourworldindata.org/coronavirus.
24. Hyndman RJ, Athanasopoulos G. Forecasting: principles and practice. OTexts; 2018. 380 p.
25. Pinheiro J, Bates D, DebRoy S, Sarkar D, R Core Team. nlme: Linear and Nonlinear Mixed Effects Models [Internet]. 2022. Available from: https://CRAN.R-project.org/package=nlme.
26. Google LLC. Google COVID-19 community mobility reports. [cited 10 Jan 2022]. Available: https://www.google.com/covid19/mobility/.
27. Jefferson A. Born to be biased? Unrealistic optimism and error management theory. Philos Psychol. 2017; 30: 1159–1175. https://doi.org/10.1080/09515089.2017.1370085
28. Moen B, Rundmo T. Predictors of unrealistic optimism: a study of Norwegian risk takers. J Risk Res. 2005; 8: 363–382. https://doi.org/10.1080/1366987042000310668
29. Tyler TR, Cook FL. The mass media and judgments of risk: Distinguishing impact on personal and societal level judgments. J Pers Soc Psychol. 1984; 47: 693–708. https://doi.org/10.1037/0022-3514.47.4.693
30. Główny Urząd Statystyczny. Wykorzystanie technologii informacyjno-komunikacyjnych w jednostkach administracji publicznej, przedsiębiorstwach i gospodarstwach domowych w 2021 roku [Internet]. stat.gov.pl. [cited 2022 Sep 30]. Available from: https://stat.gov.pl/obszary-tematyczne/nauka-i-technika-spoleczenstwo-informacyjne/spoleczenstwo-informacyjne/wykorzystanie-technologii-informacyjno-komunikacyjnych-w-jednostkach-administracji-publicznej-przedsiebiorstwach-i-gospodarstwach-domowych-w-2021-roku,3,20.html.
31. JASP Team. JASP (Version 0.16)[Computer software]. 2021. Available: https://jasp-stats.org/.
32. McColl K, Debin M, Souty C, Guerrisi C, Turbelin C, Falchi A, et al. Are People Optimistically Biased about the Risk of COVID-19 Infection? Lessons from the First Wave of the Pandemic in Europe. Int J Environ Res Public Health. 2022; 19: 436. https://doi.org/10.3390/ijerph19010436 PMID: 35010707

33. Vieites Y, Ramos GA, Andrade EB, Pereira C, Medeiros A. Can self-protective behaviors increase unrealistic optimism? Evidence from the COVID-19 pandemic. J Exp Psychol Appl. 2021; 27: 621–631. https://doi.org/10.1037/xap0000379 PMID: 34292049

34. Waters EA, Klein WMP, Moser RP, Yu M, Waldron WR, McNeel TS, et al. Correlates of unrealistic risk beliefs in a nationally representative sample. J Behav Med. 2011 Jun; 34(3):225–35. https://doi.org/10.1007/s10865-010-9303-7 PMID: 21110077

Artykuł 3 - Do unbiased people act more rationally?—The case of comparative realism and vaccine intention.

ROYAL SOCIETY OPEN SCIENCE

royalsocietypublishing.org/journal/rsos

Research

Cite this article: Izydorczak K, Dolinski D, Genschow O, Kulesza W, Muniak P, Casara BGS, Suitner C. 2023 Do unbiased people act more rationally?—The case of comparative realism and vaccine intention. *R. Soc. Open Sci.* **10**: 220775. https://doi.org/10.1098/rsos.220775

Received: 11 June 2022
Accepted: 5 January 2023

Subject Category:
Psychology and cognitive neuroscience

Subject Areas:
psychology

Keywords:
realisms, self–others comparisons, unrealistic optimism, meta-analysis, vaccine intention, COVID-19

Author for correspondence:
Kamil Izydorczak
e-mail: kizydorczak@swps.edu.pl

Do unbiased people act more rationally?—The case of comparative realism and vaccine intention

Kamil Izydorczak[1], Dariusz Dolinski[1], Oliver Genschow[2], Wojciech Kulesza[3], Pawel Muniak[3], Bruno Gabriel Salvador Casara[4] and Caterina Suitner[4]

[1]Faculty of Psychology in Wroclaw, SWPS University of Social Sciences and Humanities, Ostrowskiego 30b, 53-238 Wroclaw, Poland
[2]Social Cognition Center Cologne, University of Cologne, Koln, Nordrhein-Westfalen, Germany
[3]Warsaw Faculty, Centre for Research on Social Relations SWPS University of Social Sciences and Humanities, Wroclaw, Poland
[4]Department of Developmental and Socialization Psychology, University of Padova, Padova, Veneto, Italy

KI, 0000-0002-9870-3825; PM, 0000-0003-3983-147X

Within different populations and at various stages of the pandemic, it has been demonstrated that individuals believe they are less likely to become infected than their average peer. This is known as comparative optimism and it has been one of the reproducible effects in social psychology. However, in previous and even the most recent studies, researchers often neglected to consider unbiased individuals and inspect the differences between biased and unbiased individuals. In a mini meta-analysis of six studies (Study 1), we discovered that unbiased individuals have lower vaccine intention than biased ones. In two pre-registered, follow-up studies, we aimed at testing the reproducibility of this phenomenon and its explanations. In Study 2 we replicated the main effect and found no evidence for differences in psychological control between biased and unbiased groups. In Study 3 we also replicated the effect and found that realists hold more centric views on the trade-offs between threats from getting vaccinated and getting ill. We discuss the interpretation and implication of our results in the context of the academic and lay-persons' views on rationality. We also put forward empirical and theoretical arguments for considering unbiased individuals as a separate phenomenon in the domain of self–others comparisons.

THE ROYAL SOCIETY PUBLISHING

1. Do unbiased people act more rationally?—The case of comparative realism and vaccine intention

Since the first outbreak of COVID-19, societies have faced ongoing uncertainty regarding health and life. Describing and understanding how we process this situation is a crucial task for social and behavioural science. Furthermore, the pandemic provided a unique opportunity to further our knowledge about basic socio-cognitive processes.

An exceptional challenge comes with (re)appraising the role of rationality in the face of such an unforeseen, mass-scale threat. At the earliest stages of the pandemic, it was not unusual to find opinions from prominent psychologists warning the public about excessive panic (see [1]). This 'irrational' reaction was supposedly a distortion, a consequence of our cognitive biases, such as 'probability neglect' [2] or our shortcomings in 'risk literacy' [3]. Just a few months later, the reach and severity of the pandemic deemed the previously 'unreasonable overreaction' a necessary measure (social distancing, mask-wearing, lockdowns, etc.).

This poses the question: what is a 'rational' or 'irrational' reaction to threat and to what extent is 'debiasing' societies desirable?

The present paper presents a mini meta-analysis of a series of multi-lab studies and two pre-registered follow-up studies, examining the prevalence, possible roots and consequences of comparative realism—a lack of optimistic or pessimistic bias in the estimations of COVID-19 contraction risk. Specifically, we investigate how this bias relates to COVID-19 vaccine intention. By tackling the issue of vaccination, we test whether the absence of comparative bias might be related to more rational behaviour in the face of COVID-19 threat.

1.1. Comparative risk assessments

According to social comparison theory [4], people have an innate drive to evaluate themselves. In most cases, they do it by evaluating their own achievements, abilities and traits in comparison with others (usually their peers). Similarly, when people estimate the probability of different events, they have the tendency to 'believe that negative events are less likely to happen to them than to others, and they believe that positive events are more likely to happen to them than to others' [5, p. 807]. For example, people believe they are less likely to experience heart disease, divorce or a railway accident than their peers [5–8]. This common bias is called *comparative optimism* (CO) or *unrealistic optimism*. One of the prominent perspectives among social psychologists is that positive illusion helps people to cope with potentially threatening situations [9]. Some theorists postulate that positive illusions reduce stress and anxiety [10,11] or help people to retain a sense of personal control [12,13].

However, contrasting empirical evidence points to a negative association between comparative optimism and self-protective behaviours. For example, smokers who demonstrated comparative optimism were less likely to quit smoking, and more likely to perceive cigarettes as non-harmful [14]. Moreover, in a longitudinal study, college students who were comparatively optimistic about alcohol problems were more likely to experience them in the future [15].

Interestingly, some empirical studies found circumstances under which people hold a pessimistic bias. For example, Dolinski *et al.* [16] examined reactions among Polish citizens immediately after their exposure to nuclear radiation following the Chernobyl disaster. They found that the majority of participants believed that they were more likely to suffer radiation-related health problems than their peers—they displayed *comparative pessimism* (CP). A similar pattern of results was obtained by Burger & Palmer [17] in a study conducted after the 1989 California earthquake.

Comparative pessimism comes with possible benefits—in the aforementioned study by Dolinski *et al.* [16], those who exhibited pessimism were more likely to engage in self-protective behaviours.

1.2. Comparative realism and the goal of the present research

Summing up, optimism and pessimism are two possible outcomes of social comparisons. If individuals predict more favourable outcomes for themselves than for others, they are comparatively optimistic. If they assume more negative outcomes for themselves, they are comparatively pessimistic. As we have seen, depending on the situation, holding an optimistic or pessimistic bias can have positive or negative consequences (e.g. [15,16,18]). Strikingly, the majority of research has neglected to consider the third mode—*comparative realism* (CR).

Comparative realism can be defined as predicting one's own outcomes as similar to others' outcomes. This category has rarely been analysed in the literature (for an exception, see [19]), often confounded with comparative pessimism (e.g. [20]). We argue that this might be an important omission.

When comparative optimism is measured, there are usually multiple scale points that indicate various levels of pessimism and optimism and just one possible score that would indicate realism. Despite this, the few researchers who consider realism as a mode of thinking discovered a significant fraction of CRs (19% [20], 9.3%–56.2% [21]). Such a point-inflated distribution is common in many domains of health or environmental science [22–24] and can signal a twofold mechanism of the phenomenon: one mechanism accounts for the difference between the inflated score and other scores; the second mechanism accounts for the variance among the rest of the scores.

The number of cigarettes smoked weekly can serve as an example. If we examine this variable among the general population, we will obtain a large fraction of 'zeroes', as there are many non-smokers. Besides the inflated 'zero', we might expect a variety of scores, which will indicate the different patterns of smoking. Note that in such a case, the difference between 1 and 2 cigarettes per week is mathematically equivalent to the difference between 0 and 1. However, these differences are practically and theoretically non-equivalent. The first difference indicates a level of engagement and the second one marks the qualitative cut-off point between engagement and non-engagement.

The question arises as to whether there could be a qualitative difference between individuals who exhibit some degree of optimistic/pessimistic bias and individuals who do not exhibit it at all. In this article, we present evidence that such a qualitative difference not only exists but is relevant for health-related decision making.

The goal of the present research is to examine the role of comparative realism in vaccine intention and to identify psychological dispositions and cognitive processes related to comparative realism.[1]

2. Study 1: mini meta-analysis of the relationship between comparative bias and vaccine intention

To investigate the relationship between realism and constructive coping strategies in the context of the COVID-19 pandemic, we re-analysed six previously conducted studies that assessed: (i) comparative bias and (ii) COVID-19 vaccine intentions.

2.1. Method

When analysing a series of the authors' own studies that all share similar variables, it is advisable to combine the evidence in the form of a mini meta-analysis [25]. Such a strategy allows formal, statistical conclusions based on combined evidence and provides more precise estimates of effect size.

2.1.1. Included studies

We included six studies from various populations (table 1), conducted between 4 June and 14 August 2020. These studies were part of a multi-laboratory research programme regarding comparative optimism and contained multiple variables measuring attitudes, beliefs and behaviours related to psychological functioning during the COVID-19 pandemic.

Across six studies, we measured comparative bias by examining the estimation of getting COVID-19 for the self with the estimated risk for an average citizen (Study 6) and for both the average citizen and similar peers (Studies 1–5).

To examine the magnitude of comparative optimism and pessimism, we introduced a comparative index score (C_{index}). This score is computed as the difference in risk estimations between 'Self' and 'Others'—Positive C_{index} scores indicate comparative optimism (CO), whereas negative scores indicate comparative pessimism (CP). A C_{index} equal to zero indicates comparative realism (CR). In the case of all studies, the C_{Index} was recoded into a three-level categorical variable (CO, CR, CP).

[1]Please note that comparative optimism, pessimism or realism should not be conflated with the accuracy of judgements. On an individual level, it is almost impossible to determine whether one is right or wrong in their comparative judgements of risk. What we can detect and what serves as the focus of this paper is the presence or absence of the pessimistic/optimistic tendencies in self–others comparisons.

Table 1. Summary of the studies included in the mini meta-analysis.

nr	nationality	sampling source	time	*N*	comparative optimists	comparative realists	comparative pessimists
1	German	local online panel	10.07.20–22.07.20	129	61 (47.3%)	39 (30.2%)	29 (22.5%)
2	Italian	social media	05.07.20–16.07.20	100	68 (68%)	22 (22%)	10 (10%)
3	American	M-Turk	22.07.20	181	100 (55.2%)	34 (18.8%)	47 (26%)
4	Polish	students at a local university	05.08.20–14.08.20	565	253 (44.8%)	256 (45.3%)	56 (9.9%)
5	Polish	students at a local university	05.07.20–19.07.20	440	195 (44.3%)	189 (43%)	56 (12.7%)
6	American	Prolific	04.06.20	994	574 (57.7%)	263 (26.5%)	157 (15.8%)
				2409	1251 (51.9%)	803 (33.3%)	355 (14.7%)

In the first five studies, the comparative bias was measured by the same three questions, which were always translated into the native language of our target sample:

Risk_{Me}: *How likely is it that you will become infected with coronavirus (SARS-CoV-2/COVID-19)?*
$\text{Risk}_{\text{Peer}}$: *How likely is it that your average friend, or your average neighbour, will become infected with coronavirus (SARS-CoV-2/COVID-19)?*
$\text{Risk}_{\text{Coutrymen}}$: *How likely is it that your average fellow-countryman will become infected with coronavirus (SARS-CoV-2/COVID-19)?*

All the aforementioned questions were answered on a 1 (absolutely impossible)–11 (quite certain) Likert-like scale.

From these questions, the C_{Index} was calculated, using the following formula:

$$C_{\text{Index}} = (\text{Risk}_{\text{Peer}} - \text{Risk}_{\text{Me}}) + (\text{Risk}_{\text{Coutrymen}} - \text{Risk}_{\text{Me}}).$$

In Study 6, comparative bias was measured on two levels, using Risk_{Me} and $\text{Risk}_{\text{Coutrymen}}$, so the formula was: $C_{\text{Index}} = (\text{Risk}_{\text{Coutrymen}} - \text{Risk}_{\text{Me}})$

In all six combined studies, we identified 51.93% of 'comparative optimists', 33.33% of 'comparative realists' and 14.73% of 'comparative pessimists' (figure 1).

2.1.2. Variables

In all studies, the participants were asked the same question regarding their intention to vaccinate against COVID-19:

> I will take the vaccine for the coronavirus/SARS-CoV-2 once it becomes available.

Participants provided their answers on an 11-point scale (1 = *absolutely impossible*, 11 = *quite certain*).

It is worth noting that at the time of data collection for Study 1, the SARS-CoV-2 vaccine was not yet available in any of the participants' countries, so the question about vaccine intention was hypothetical.

2.1.3. Analysis

We conducted three separate mini meta-analyses using vaccine intention as a dependent variable and three comparisons between three comparative types as grouping variables: CR versus CO, CP versus CO and CR versus CP.

For each of the six studies, we extracted the effect size (rank-biserial correlation), standard error of effect size and sample size. To analyse our data, we performed a random-effect meta-analysis, using REML estimation.

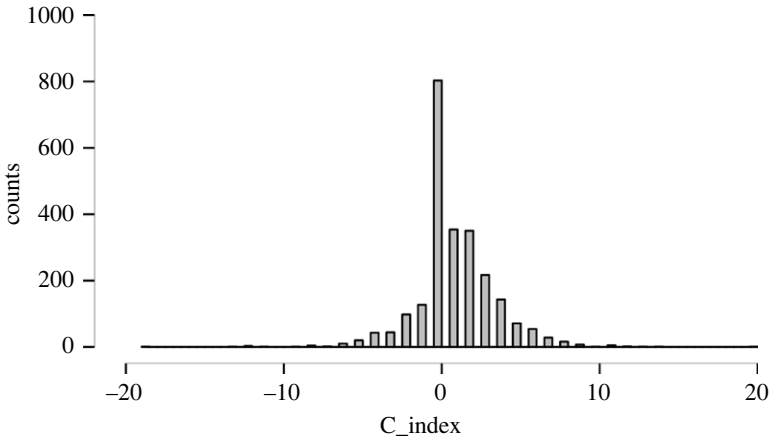


Figure 1. Distribution of C_{Index} across six studies ($n = 2409$).

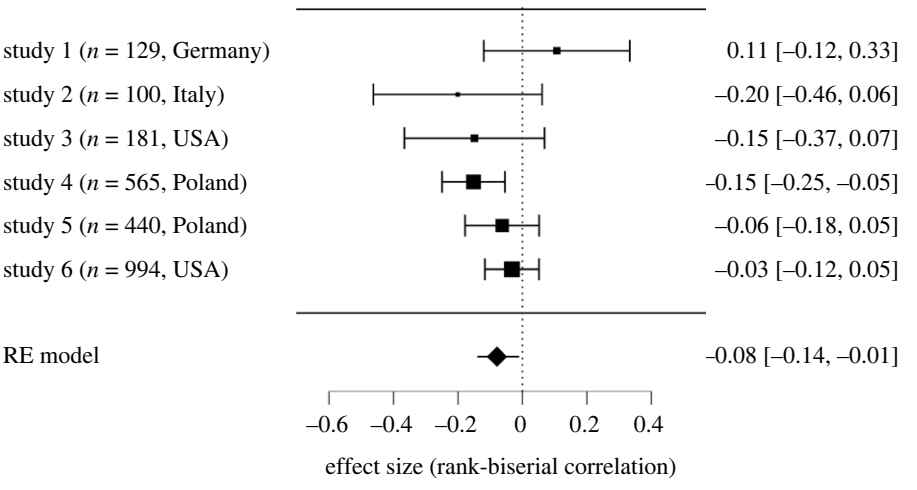


Figure 2. Forest plot—difference in vaccine intention between comparative realists (CRs) and comparative optimists (COs).

All analyses were conducted in JASP v. 0.14.1 [26]. Databases are available along with the described analysis (https://osf.io/skc5d/).

2.2. Results

CRs were less eager than COs to vaccinate for COVID-19 (figure 2): $M_{CR} = 6.36$, s.d.$_{CR} = 3.40$; $M_{CO} = 6.98$, s.d.$_{CO} = 3.06$. The meta-analytic correlation was $r_{rb} = -0.08$ and the Wald test yielded significant results, $z = -2.38$, $p = 0.017$. Analysed effects proved to be homogeneous: $Q = 7.18$, d.f. = 5, $p = 0.207$, $\tau^2 = 0.00$, 95% CI [0.00, 0.06], $\tau = 0.04$, 95% CI [0.00, 0.25], $I^2 = 26.69\%$.

As shown in figure 3, a reluctance by realists was also found in the comparison with pessimists: $M_{CR} = 6.36$, s.d.$_{CR} = 3.40$; $M_{CP} = 7.38$, s.d.$_{CP} = 2.78$. Meta-analytic rank-biserial correlation was $r_{rb} = -0.14$, the Wald test yielded significant results, $z = -3.74$, $p < 0.001$. Analysed effects proved to be homogeneous: $Q = 1.33$, d.f. = 5, $p = 0.931$, $\tau^2 = 0.00$, 95% CI [0.00, 0.01], $\tau = 0.00$, 95% CI [0.00, 0.10], $I^2 = 0.00\%$.

We did not find a significant difference between CPs and COs (meta-analytic $r_{rb} = 0.08$, Wald's $z = 1.87$, $p = 0.062$). Analysed effects proved to be homogeneous: $Q = 7.69$, d.f. = 5, $p = 0.174$, $\tau^2 = 0.00$, 95% CI [0.00, 0.09], $\tau = 0.06$, 95% CI [0.00, 0.30], $I^2 = 31.86\%$. See electronic supplementary material for forest plot.

2.3. Discussion

Our meta-analysis indicated that realists displayed the lowest vaccine intention, with pessimists displaying the highest intention. The finding that pessimists are most likely to engage in active,

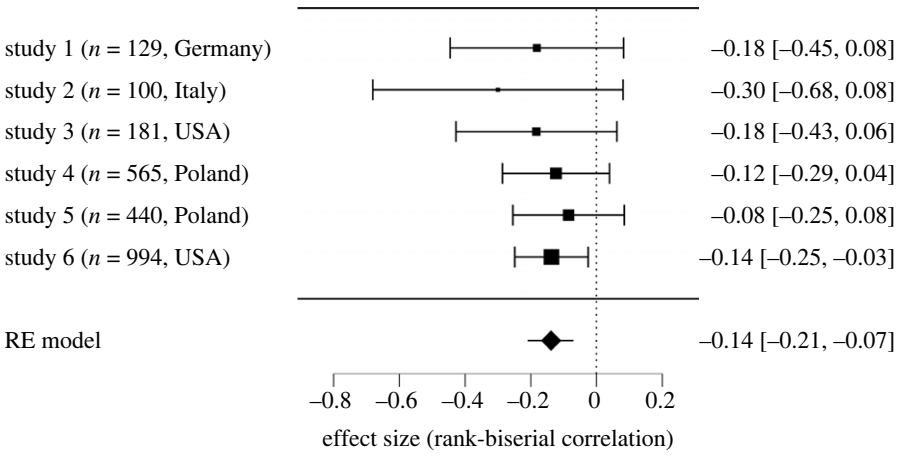


Figure 3. Forest plot—difference in vaccine intention between comparative realists (CRs) and comparative pessimists (CPs).

preventive behaviours corresponds with previous research on nuclear risks [16] and current research on COVID-19 that reported a negative correlation between optimistic bias and vaccine intention [27]. But contrary to the aforementioned studies, the relationship is not linear. Moreover, when we try to interpret this relationship assuming that the optimistic bias is a simple, continuous variable with realism as a middle point, we encounter serious difficulties—pessimists did not significantly differ from optimists, and realists were less willing to vaccinate than both biased groups.

Although the effects were small, they are nevertheless theoretically and practically important. Theoretically, our effects were contrary to predictions and thus deserve attention. Practically, small effects can have impressive consequences when viewed at the population level [28]. Moreover, our small findings may prove important for understanding vaccine hesitancy, which is among the greatest threats to global health [29].

The fact that realists were the most vaccine-hesitant group is somewhat unexpected and to the best of our knowledge, there are no hints in the previous literature that would suggest such a phenomenon. One could argue that realists might have a lower vaccine intention because they perceive lower absolute risk levels than both biased groups. However, this explanation cannot account for our data, because there is no significant difference between realists, optimists and pessimists in terms of average risk estimations: the meta-analytical estimate coefficients were not significantly different from '0' for both the comparisons between 'realists' and 'optimists' (meta-analytic $r_{rb} = 0.01$, Wald's $z = 0.42$, $p = 0.676$) and 'realists' and 'pessimists' (meta-analytic $r_{rb} = 0.04$, Wald's $z = 0.92$, $p = 0.359$) (see electronic supplementary material for plots and detailed analyses).

Another explanation for the difference in vaccine intention between realists and both biased groups pertains to their level of engagement in responses. Realism could be an artefact rooted in low-effort responses. That is, less motivated participants may have clicked all the risk levels (for 'self', 'peer' and 'citizen') in the same manner to finish the survey more quickly. However, we did not find a significant difference in the time spent on the survey. The completion time information was available in four out of six studies and it did not differ between realists and optimists ($U = 124618.00$, r_{rb} (993) = 0.01, $p = 0.752$) or between realists and pessimists ($U = 29209.00$, r_{rb} (604) = 0.01, $p = 0.837$)

To further the understanding of the detected differences, we assessed two follow-up, pre-registered studies with the aim to test possible explanations for lower vaccine intentions among realists. The first follow-up study examined the role of locus of control [30,31] and desirability for control [32].

3. Study 2: relationship between 'realism' and vaccine intention—the role of locus of control and desirability for control

A prominent view in the literature suggests that comparative optimism may be rooted in the sense of psychological control (e.g. [33]). The relationship between control and intention to vaccinate against COVID-19 can be rooted both in a cognitive or motivational perspective, namely the belief or the desire to be in control of one's health.

These two perspectives can match two psychological constructs, namely locus of control and desire for control. *Locus of control* (LoC) refers to how much control a person feels they have over their own actions. People with internal locus of control believe they have personal control over their behaviour [30]. *Desire for control* (DfC), on the other hand, is defined as the extent to which individuals are 'motivated to feel as if they are in control of the events in their lives' [32, p. 148].

There is evidence indicating that both LoC and DfC are related to optimistic bias. On the one hand, a meta-analysis indicates that individuals who perceive more control over an event are more likely to be optimistically biased when asked about the chances of this event [12]. Moreover, Hoorens & Buunk [34] demonstrated that high-school students with a higher internal locus of control are more likely to display CO in relation to health problems.

Likewise, several studies found that different aspects of psychological control are related to vaccine intentions [35–37].

Given that sense of personal control is positively related to optimistic bias, we assumed that realists will have a lower internal locus of control and desirability for control than optimists. Furthermore, since psychological control proved to be related to vaccine intention, we predicted that LoC and DfC are good candidates for mediators of the relationship between optimistic bias and vaccine intention.

In Study 2, we assessed the degree to which high internal LoC and DfC accounts for the relation between comparative optimists and willingness to vaccinate.

3.1. Method

We pre-registered two hypotheses (https://osf.io/5csr9):

H1: Realists have a lower sense of personal control over pandemic situations than comparative optimists.
H2: Personal locus of control mediates the relationship between categorical C_{Index} (realists/optimists) and vaccine intention. Realists will have lower vaccine intention and a lower personal locus of control.

3.1.1. Sample size justification, participants

We aimed to recruit a sample that would allow for meaningful statistical inferences concerning 'realists'. A meaningful inference was defined as obtaining 80% power to detect an effect size of $d = 0.2$ with an alpha level of 0.05. We chose an effect size of $d = 0.2$ because in Study 1 the average effect size for the difference between realists and optimists in vaccine intention was $d = 0.19$. We decided to treat the effect size identified in the mini meta-analysis as the minimal effect size of interest because our empirical results were the only known rationale for our prediction. Besides these results, we had no other reason to expect any effect in this direction. Indeed, theoretical predictions would suggest an effect in the opposite direction. For that reason, we decided that (i) finding any effect in the same direction as in the mini meta-analysis would be theoretically interesting, and (ii) since we did not have enough resources to search for any minimal effect, we planned to search for an effect that was most plausible, judging by our latest empirical data.

An *a priori* power analysis for two independent groups and a one-tailed test indicated that we needed at least 310 participants per group. Based on previous research, we estimate that 33% of the population consists of realists, so we decided to recruit 1000 participants and then check whether we obtained the desired 310 realists.

Unfortunately, 1000 participants proved to be insufficient, as the percentage of realists turned out to be lower. Thus, we decided to recruit an additional 400 participants, obtaining 275 CRs (19.59%), 1013 COs (72.15%) and 116 CPs (8.26%). Although we did not reach the desired number of realists, resource constraints forced us to end the sampling.

The final sample consisted of 1404 participants across 65 nationalities (652 males, 747 females, 1 non-disclosed and 4 missing answers, $M_{\text{Age}} = 24.63$, min. $_{\text{Age}} = 18$, max. $_{\text{Age}} = 65$). Detailed information on sample demographics is available in the electronic supplementary material (https://osf.io/fndjc). Please note that, since we calibrated the power of our study to be enough to detect meaningful effects with respect to comparisons with realists, it would not be enough to detect analogical effects when it comes to pessimists (the least numerous category). For that reason, we did not conduct any analyses concerning pessimists.

As pre-registered, we excluded the participants who did not match our screening criteria, namely those who were either vaccinated against COVID-19 or had been officially diagnosed with this disease

in the past. Besides these two filters, we allowed the panel to source participants from all available countries, without any quotas on demographic characteristics.

3.1.2. Procedure

Data were collected via an online questionnaire through *Prolific* from 31 May to 15 June 2021.

After providing informed consent, participants were asked the pre-screening questions regarding the vaccination and COVID-19 infection, then about their vaccine intention. Next, they answered a block of questions diagnosing locus of control, desirability for control and comparative bias (in a randomized order). All questions used a 'forced response' option, which made proceeding to the next question impossible unless the participant provided a response for the current one. The demographic data were delivered by the Prolific panel.

The study was approved by the local ethics committee. The questionnaire in the .qsf and .pdf file is available in the electronic supplementary material (https://osf.io/mc23e).

3.1.3. Variables

3.1.3.1. Comparative bias

Comparative bias was assessed via three questions:

Risk_{Me}: *How likely is it that you will become infected with coronavirus (SARS-CoV-2/COVID-19)?*

$\text{Risk}_{\text{Peer}}$: *How likely is it that your average friend, or your average neighbour, will become infected with coronavirus (SARS-CoV-2/COVID-19)?*

$\text{Risk}_{\text{Coutrymen}}$: *How likely is it that your average fellow-countryman will become infected with coronavirus (SARS-CoV-2/COVID-19)?*

All the aforementioned questions were answered on a 1 (absolutely impossible)–11 (quite certain) Likert-like scale. The answers were provided on a slider scale, with the default position as '1'.

The magnitude and the direction of comparative bias were calculated, using the following formula: $C_{\text{Index}} = (\text{Risk}_{\text{Peer}} - \text{Risk}_{\text{Me}}) + (\text{Risk}_{\text{Coutrymen}} - \text{Risk}_{\text{Me}})$. C_{index} was then recoded into three categories, Those with $C_{\text{index}} =$ '0' were categorized as comparative realists (CRs), those with positive C_{index} were comparative optimists (COs) and those with negative C_{index} comparative pessimists (CPs).

3.1.3.2. Vaccine intention

The intention to get vaccinated was measured with the item: 'I will take the vaccine for the coronavirus/SARS-CoV-2'.

Participants provided their answers on an 11-point scale (1 = *absolutely impossible*, 11 = *quite certain*). The answers were provided on a slider scale, with the default position as '1'.

Participants were also asked to briefly justify their answer in an open text box.

3.1.3.3. Locus of control

Locus of control was measured with the brief version of Levenson's 'locus of control scale' [31]. The questionnaire consisted of nine statements which were evaluated by participants on a 7-point rating scale (1 = *strongly disagree*, 7 = *strongly agree*). The scale is divided into three subscales: internal control (e.g. 'My life is determined by my own actions'; Cronbach's $\alpha = 0.63$), 'chance' (e.g. 'To a great extent, my life is controlled by accidental happenings'; Cronbach's $\alpha = 0.60$) and 'powerful others' (e.g. 'I feel like what happens in my life is mostly determined by powerful people'; Cronbach's $\alpha = 0.72$). The score for all subscales was computed as a sum of ratings on all items.

3.1.3.4. The desirability of control

We measured desirability of control with the 'desirability of control scale' [32] which consists of 20 7-point statements (1 = *the statement does not apply to me at all*, 7 = *the statement always applies to me).* A sample item is: 'I prefer a job where I have a lot of control over what I do and when I do it'. (Cronbach's $\alpha = 0.79$). The score was computed as a sum of ratings on all items.

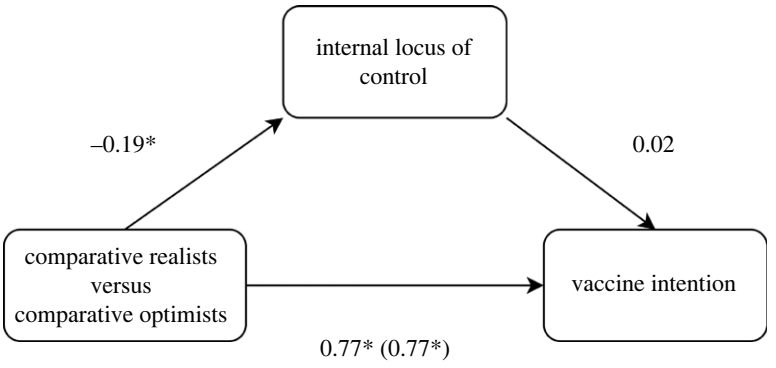


Figure 4. Path plot for mediation model with 'Vaccine intention' as the dependent variable, categorical CIndex (CR versus CO) as a predictor and Internal Control as the mediator.

3.2. Results

R programming language [38] was used to transform the data and JASP v. 0.14.1 [26] was used for statistical analysis. All analysis scripts are available at the OSF (https://osf.io/skc5d/).

The distribution of categories regarding the C_{Index} was: CRs, 19.59% of the sample; COs, 72.15%; and CPs, 8.26%. This distribution corresponds with the distribution obtained in the mini meta-analysis.

Also, the main effect discovered in the meta-analysis was confirmed as CRs had significantly lower vaccine intentions than COs: $U = 126173.50$, r_{rb} (1288) = −0.09, $p = 0.008$. Mean vaccine intention for CRs was $M = 8.62$, s.d. = 3.28. For COs it was $M = 9.38$, s.d. = 2.56. The visualization of distributions are available at the OSF (https://osf.io/fndjc).

3.2.1. Confirmatory analyses

To test the first pre-registered hypothesis (i.e. comparative realists have a lower sense of personal control over the pandemic situation than comparative optimists), we conducted an independent samples comparison with the LoC 'internal control' subscale as a dependent variable and categorical C_{Index} (CRs/COs) as a grouping variable. Distribution of C_{index} proved to significantly deviate from the normal distribution; for that reason, we decided to use non-parametric statistics. Parametric analyses are available at the OSF and they yield the same conclusions.

A Mann-Whitney test yielded non-significant results = 142273.00, r_{rb} (1288) = 0.02, $p = 0.709$. An additional Bayesian analysis provided evidence in favour of the null hypothesis. Using zero-centred Cauchy's prior distribution with scale parameter $\lambda = 0.2$, we obtained a Bayes Factor in favour of the null hypothesis, $BF_{01} = 2.67$, which means that our data were two times more probable under the true null hypothesis. Conventionally, this result should be interpreted as 'anecdotal' evidence in favour of the null hypothesis [39]. The robustness analysis indicates that in order to obtain conclusive evidence (BF > 6), the prior scale should be $\lambda > 0.52$.

Also, our second hypothesis (i.e. personal locus of control mediates the relationship between categorical C_{Index} (CRs/COs) and vaccine intention; realists will have lower vaccine intention and lower personal locus of control) was also disconfirmed. The bootstrapped mediation analysis (1000 replication, biased corrected percentile, *ML* estimator) indicated that while there is a significant total effect ($b = 0.77$, s.e. = 0.19, $p < 0.001$) and a direct effect ($b = 0.77$, s.e. = 0.19, $p < 0.001$) of categorical C_{Index} on vaccine intention, no significant indirect effect of personal locus of control is present ($b <$ 0.00, s.e. = 0.01, $p = 0.522$). See figure 4 for a summary of the mediation model.

Additionally, we decided to test whether the results for our hypotheses would change if we used slightly different ways of distinguishing between comparative realists and comparative optimists. We tested three alternative variants. In the first, we used more liberal criteria to identify realists. Instead of $C_{index} =$ '0', we defined CRs as C_{index} between '−1' and '1' and COs as $C_{index} > 1$. In the second variant, we computed C_{index} using only '$Risk_{Me}$' and '$Risk_{Peer}$' – $C_{index} = Risk_{Peer} - Risk_{Me}$'. In the third variant, we computed C_{index} using only '$Risk_{Me}$' and '$Risk_{Countrymen}$' – $C_{index} = Risk_{Countrymen} - Risk_{Me}$'.

All three alternative analyses yielded the same conclusions—the hypotheses were not confirmed. The analyses can be found in the OSF folder (https://osf.io/skc5d/).

3.2.2. Exploratory analyses

The previous analyses ruled out that internal locus of control explains the relationship between realism and vaccine intention. Thus, we explored whether any specific dimension of locus of control is related to vaccine intention or comparative bias.

We found that neither the *powerful others* nor the *desirability for control* subscale differs between CRs and COs. Only for the *Chance* subscale did the two groups differ significantly. That is, realists had higher ratings on the *chance* subscale, $U = 128276.00$, r_{rb} (1288) = −0.08, $p = 0.024$.

Neither the *chance* nor the *powerful others* subscale mediated the relationship between categorical C_{Index} and vaccine intentions. Moreover, from all examined control-related variables, only one was related to vaccine intentions. Vaccine intentions correlated negatively with the *powerful others* subscale of *locus of control:* $r_{1404} = -0.06$, $p = 0.028$.

3.2.3. Qualitative analyses

In order to analyse participants' open answers, structural topic models were used with the stm package [40] of the software R [38]. The structural topic model assumes that documents are produced from a mixture of topics. Topics are then generated from a distribution of words. Based on these assumptions, stm generates topics of correlated words and assigns to each document a proportion of each topic. The function *textProcessor()* was used to clean the text. In order to decide the number of topics to extract, the fit of 30 models (from 1 to 30 topics) was compared. The best solution was chosen based on the highest held-out likelihood [41]. The output favoured a model with 21 topics. After that, using the function *estimateEffect()*, we tested how vaccine compliance and realism affected the prevalence of each topic. Interestingly, the prevalence of five topics was negatively affected by vaccine intentions:

(1) Side-effects ($B = -0.005$, s.d. = 0.001, $p < 0.001$). Example: 'I'm still concerned about the possible side effects'.
(2) Distrust ($B = -0.003$, s.d. = 0.003, $p = 0.003$). Example: 'I don't trust the hurried development of it, it does not guarantee any immunity and I won't let anyone put an experimental thing inside my body'.
(3) Side-effects due to time-related issues ($B = -0.003$, s.d. = 0.001, $p = 0.002$). Example: 'I am not convinced of this vaccine as its testing was short. I want to see if people who are currently vaccinated will suffer (or not) from the vaccine'.
(4) Time-related worries ($B = -0.002$, s.d. = 0.001, $p = 0.007$). Example: 'I don't trust a vaccine that was developed in such a short period of time'.
(5) Side-effects 2 ($B = -0.008$, s.d. = 0.001, $p < 0.001$). Example: 'Unsure about the side effects so I am hoping to wait to see how it is going to be'.

Additional analyses indicated that the first three topics were more prevalent among realists compared with 'biased' participants ($B1 = 0.01$, s.d.$1 = 0.005$, $p = 0.05$; $B2 = 0.02$, s.d.$2 = 0.006$, $p = 0.006$; $B3 = 0.016$, s.d.$3 = 0.006$, $p = 0.005$).

Moreover, five other topics were positively associated with vaccine intentions:

(1) Trust in science ($B = 0.003$, s.d. = 0.001, $p < 0.001$). Example: 'I believe in science'.
(2) Solution to the pandemic situation ($B = 0.005$, s.d. = 0.001, $p < 0.001$). Example: 'In my opinion it is the only way to control the situation and protect the population'.
(3) General support for vaccination through trust in the country ($B = 0.003$, s.d. = 0.001, $p < 0.001$). Example: 'Because in my country we have good medicine support'.
(4) Vaccine as a solution for affiliation needs ($B = 0.003$, s.d. = 0.001, $p < 0.001$). Example: 'I want to take the vaccine so I can hug my friends and family again without the fear of making them sick'.
(5) Vaccination to protect others ($B = 0.002$, s.d. = 0.001, $p < 0.001$). Example: 'I need to be as protected for this as possible in order to take care of my loved ones'.

In particular, the first topic was more prevalent for realistic participants ($B = 0.022$, s.d. = 0.007, $p = 0.002$).

3.3. Discussion

Despite the clear prediction substantiated by theory and previous research, personal locus of control proved to be unrelated to comparative optimism. While this result comes as a surprise, there are

hints in the existing literature as to why it might have occurred. In the aforementioned meta-analysis of relationships between comparative optimism and sense of control [12], the authors identified an important moderator of the effect—exposure to risk. Among those who were less risk-exposed, the relationship between control and comparative optimism was significant, but among those who were at high risk of exposure, the relationship was not present. It might be the case that in the COVID-19 pandemic, we all feel highly threatened, which hampers the relationship between comparative optimism and sense of control.

Another explanation for this result is that while general, dispositional locus of control or desirability for control might be unrelated to comparative bias regarding COVID-19 infection, a sense of control over COVID-19 infection, in particular, might be. Bearing that in mind, our results contrast research that examined general LoC (e.g. [34]) but not necessarily that which examined specific LoC (e.g. [12]).

Another unexpected pattern is related to vaccine hesitancy which was almost unrelated to psychological control. Paradoxically, the single most effective measure that one can take personally in the face of global and overwhelming threat is not related to the preference for personal control or to the belief in possessing control. While we write this discussion, papers appear on a daily basis providing novel evidence about the psychological underpinnings related to vaccine intention. So, to the best of our current knowledge, mixed results are available, with some reporting that vaccine acceptance is positively [42] and some negatively related [37] to the external locus of control. There are also studies reporting a negative link with internal locus of control (e.g. [43]) and others indicating no link at all or an extremely weak link [44,45]. This makes control a variable that needs further investigation, possibly identifying key moderators, but ultimately not the best candidate to explain differences between realist and biased respondents.

Interestingly, the qualitative analyses revealed that risk perception related to vaccination side effects is a relevant topic associated with a reduced intention to get the COVID-19 vaccine. This suggests that in order to understand the differences between CRs and COs in terms of vaccine intention, it is fundamental to analyse how these two groups perceive the threat related to vaccination side effects. Indeed, it is plausible that CO participants may be optimistic not only about the risk of COVID-19 contraction but also about the risk of vaccination-related side effects. Finally, the open question analysis suggests that realists are more critical about the time needed to develop an effective and safe vaccine against COVID-19.

4. Study 3: relationship between comparative bias and vaccine intention—the role of perceived threat of COVID-19 illness and COVID-19 vaccine

Upon concluding that variables related to psychological control are not suitable explanations for the relationship between realism and vaccine intention, we searched for another possible mechanism.

To date, in most of the studies regarding comparative optimism in the context of the COVID-19 pandemic, researchers have concentrated on comparative optimism as an independent variable—they were looking for outcomes of it and not for its roots. But to understand the surprising finding that those who do not display comparative optimism for COVID-19 infection are less willing to get vaccinated, we decided to test the possible mechanisms of why comparative optimism emerges in the first place.

If CO is a reaction to a stressful situation (and possibly an adaptive one, or at least not inherently maladaptive; see [46]), then its strength should depend on the seriousness of the perceived threat.

Analogically, the intention to get vaccinated should also depend on the perceived level of threat from COVID-19, but with one important addition: the decision to vaccinate and to engage in other COVID-19 preventive measures also comes with possible negative consequences. We hypothesized that the final decision to get vaccinated must derive not only from the perceived threat from COVID-19 but also from the perceived threat from negative side effects of vaccination. Such a notion is supported by Study 2's qualitative analysis, in which those more opposed to vaccination were likely to mention fears and doubts regarding a vaccine's safety, a concern mirrored by realists.

Summing up, both realists and those less willing to vaccinate might share similar views on the severity of threats from COVID-19 illness and the COVID-19 vaccine: they might perceive illness as less dangerous and vaccines as more dangerous than optimists and vaccine-enthusiasts.

4.1. Method

Before the data collection, we pre-registered three hypotheses (see full pre-registration form: https://osf.io/387pt):

H1: CRs will hold a stronger belief that the development of COVID-19 vaccines was rushed too much (when compared with comparative optimists).
H2: CRs will have a lower COVID-19/vaccination fear ratio.
H3: Vaccine intention will correlate positively with COVID-19/vaccination fear ratio.

4.1.1. Deviations from the pre-registered protocol

Post-data collection, we decided to change one feature of our pre-registered protocol in response to feedback from reviewers and readers. In our initial protocol we planned to compute the COVID-19/vaccination fear ratio, but for the sake of simplicity and consistency with the epidemiological literature, we decided to compute this variable as a difference instead of a ratio. Therefore, in the final form, the H3 reads 'Vaccine intention will correlate positively with the difference between the fear of COVID-19 and the fear of COVID-19 vaccine ($\text{Threat}_{\text{Difference}}$)'.

The analyses for the pre-registered variable can be found in the OSF folder and they lead to the same conclusions as analyses presented in the paper.

4.1.2. Sample size justification, participants, procedure

Sample size justification was almost identical to that in Study 2. We strived to obtain the same power and the same alpha level to detect the same effect size. The only difference was the expected share of 'realists'. Judging by the results from Study 2, we lowered the expected percentage of 'realists' to 20%, and to ensure the desired power we decided to recruit 1500 participants.

The final sample consisted of 1508 participants across 74 nationalities (563 males, 937 females, 3 non-disclosed, 5 missing data, $M_{\text{Age}} = 25.69$, $\text{min.}_{\text{Age}} = 18$, $\text{max.}_{\text{Age}} = 65$). For detailed information on sample demographics see the electronic supplementary material (https://osf.io/dp3n4).

As in Study 2, we excluded participants who were either vaccinated against COVID-19 or had been officially diagnosed with COVID-19. Moreover, we screened-out participants who took part in Study 2. Analogically to Study 2, *Prolific* sourced participants from all available countries, without quotas on demographics.

Data were collected online from 13 to 20 August 2021 from the *Prolific* panel. All questions used a 'forced response' option, which made proceeding to the next question impossible unless the participant provided a response for the current one. This study was approved by the local ethics committee. The questionnaire in the .qsf and .pdf file is publicly available in the electronic supplementary material (https://osf.io/4pd7v).

4.1.3. Variables

4.1.3.1. Comparative bias and vaccine intention

Comparative bias was assessed by the same three questions as in Study 1 and 2, inquiring about the perceived chance of COVID-19 infections for 'me', 'peer' and 'countrymen'. The questions were answered on a 1 (absolutely impossible)–11 (quite certain) Likert-like scale. The answers were provided on a slider scale, with the default position as '1'.

The comparative index was also calculated as previously: $C_{\text{Index}} = (Q2 - Q1) + (Q3 - Q1)$ and as previously, C_{index} was recoded into three categories: $C_{\text{index}} = 0$ (CRs, comparative realists), $C_{\text{index}} > 0$ (COs, comparative optimists) and $C_{\text{index}} < 0$ (CPs, comparative pessimists).

The intention to get vaccinated was measured with the item: 'I will take the vaccine for the coronavirus/SARS-CoV-2'.

Participants provided their answers on an 11-point scale (1 = *absolutely impossible*, 11 = *quite certain*). The answers were provided on a slider scale, with the default position as '1'.

4.1.3.2. Belief in rushed vaccine development

This variable was measured by a single item: *How much do you agree with the statement: 'The development of COVID-19 vaccines was rushed too much'?*

Participants were asked to provide answers on an 11-point scale (1 = *totally disagree*, 11 = *totally agree*).

4.1.3.3. COVID-19 Disease and vaccine threat difference

In respect to COVID-19 disease threat estimates, the participants were first asked an open-ended question: *Please note down the first negative outcome of the COVID-19 infection that comes to your mind*.

In the next step, they were asked about the severity of this negative outcome:

Q1: How serious is this effect of the COVID-19 infection?

The answers were provided on an 11-point scale (1 = *not serious at all*, 11 = *most serious possible*).

Afterwards, they were asked about the perceived probability of this negative outcome:

Q2: What are the chances of suffering from the listed effects of the COVID-19 infection?

The answers were provided on an 11-point scale (1 = *almost impossible*, 11 = *almost certain*).

By multiplying the severity by probability, we computed a 'negative expected value' of COVID-19 disease: $\text{Threat}_{\text{Disease}} = \text{Q1} \times \text{Q2}$.

Regarding COVID-19 vaccination, we asked an analogical sequence of questions:

Vaccine open-ended threat: *Please note down the first negative outcome of the COVID-19 vaccination that comes to your mind*.

Q3: How serious is this side-effect of the COVID-19 vaccination?

Q4: What are the chances of suffering from this side-effect of the COVID-19 vaccination?

By multiplying the severity by probability, we computed a 'negative expected value' of COVID-19 vaccination: $\text{Threat}_{\text{Vaccine}} = \text{Q3} \times \text{Q4}$.

We computed a difference between threat from the disease and threat from vaccination:

$$\text{Threat}_{\text{Difference}} = \text{Threat}_{\text{Disease}} - \text{Threat}_{\text{Vaccine.}}.$$

4.2. Results

R programming language [38] was used to transform the data and JASP v. 0.14.1 [26] was used for the statistical analysis.

The distribution of categories of the C_{Index} was: 'CRs', 20.09% of the sample; 'COs', 70.16%; and 'CPs', 9.75%.

Again, the main effect was confirmed: comparative realists had significantly lower vaccine intention than comparative optimists: $U = 198551.00$, r_{rb} (1361) = 0.24, $p < 0.001$.

Mean vaccine intention for CRs was $M = 5.26$, s.d. = 3.61. For COs it was $M = 6.78$, s.d. = 3.59. The visualization of distributions are available at the OSF (https://osf.io/dp3n4).

4.2.1. Confirmatory analyses

Since C_{index} and vaccine intention proved to have distributions significantly different from normal, we decided to test non-parametric statistics. Parametric analyses can be found in the OSF repository and they yield the same conclusions. To test H1 (realists will hold a stronger belief that the development of COVID-19 vaccines was rushed too much), we conducted an independent samples comparison with 'belief in rushed vaccine development' as a dependent variable and categorical C_{Index} (CRs/COs) as a grouping variable. Our hypothesis was confirmed—the Mann-Whitney test yielded significant results ($U = 130034.00$, $r_{\text{rb}}(1361) = -0.19$, $p < 0.001$).

H2 (realists will have a lower $\text{Threat}_{\text{Difference}}$) was also confirmed. An independent samples comparison with $\text{Threat}_{\text{Difference}}$ as the dependent variable and categorical C_{Index} (CRs/COs) as a grouping variable indicated significant differences in the predicted direction ($U = 190418.50$, r_{rb} (1361) = 0.19, $p < 0.001$).

To test H3 (vaccine intention will correlate positively with $\text{Threat}_{\text{Difference}}$) we used Spearman's rank correlation, because the vaccine intention variable deviates from the assumption of normal distribution (figure 5).

The hypothesis was confirmed—$\text{Threat}_{\text{Difference}}$ proved to be moderately correlated with vaccine intention ($rs_{1508} = 0.49$, $p < 0.001$) (figure 5).

Analogous to Study 2, we tested the hypotheses using three alternative operationalizations of CRs and COs: (i) CRs defined as C_{index} between '−1' and '1' and COs as $C_{\text{index}} > 1$; (ii) C_{index} computed as $\text{Risk}_{\text{Peer}} - \text{Risk}_{\text{Me}}$, and (iii) C_{index} computed as $\text{Risk}_{\text{Countrymen}} - \text{Risk}_{\text{Me}}$.

All three alternative analyses yielded the same conclusions—H1 and H2 were confirmed. The analyses can be found in the OSF folder (https://osf.io/skc5d/).

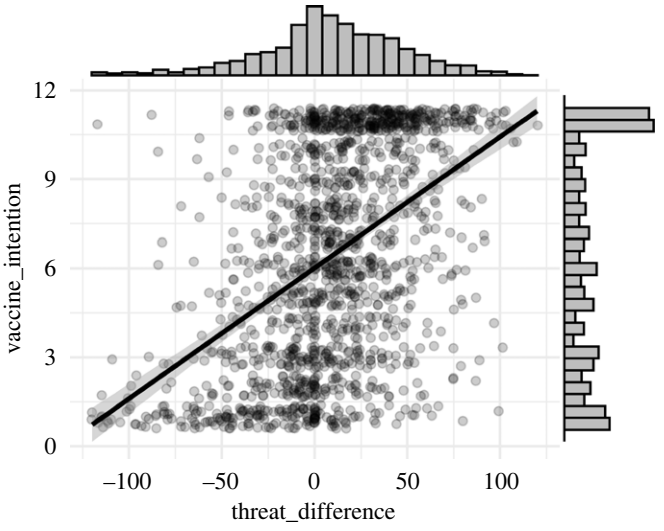


Figure 5. Correlation between $\text{Threat}_{\text{Difference}}$ and vaccine intention along with the distribution plots of the two variables. Scatterplot points have been jittered, ribbons around regression line represents 96% CI.

4.2.2. Exploratory analyses

Our predictions were all confirmed. Lower COVID-19 disease–vaccination $\text{Threat}_{\text{Difference}}$ is associated with both 'realism' and vaccine intention. Additionally, we identified one concrete and common concern that is more prevalent among comparative realists than comparative optimists, namely the concern about vaccine development being rushed too much.

In the next step, we decided to explore mediation models. The first model tested categorical C_{Index} ('CRs' coded as 0 versus 'COs' coded as 1) as a predictor, vaccine intention as a dependent variable and $\text{Threat}_{\text{Difference}}$ as a mediator (figure 6). The mediation analysis (Delta method standard errors, ML estimator, standardized coefficients) indicated that there was a significant total effect ($B = -0.41$, s.e. = 0.06, $p < 0.001$) and direct effect ($B = -0.26$, s.e. = 0.06, $p < 0.001$) of categorical C_{Index} on vaccine intention. We detected a significant indirect effect of $\text{Threat}_{\text{Difference}}$: $B = -0.15$, s.e. = 0.03, $p < 0.001$. Total effect of C_{Index} on vaccine intention was positive, which means that comparative optimism (as opposed to realism) predicts higher vaccine intention. The model accounted for 23% of variance in vaccine intention, and the mediator $\text{Threat}_{\text{Difference}}$ accounted for 37% of the total effect.

The second mediation model assumed that the categorical C_{Index} is an outcome variable. It was meant to represent the theoretical model in which engagement in various COVID-19 preventive strategies may lead an individual to be comparatively optimistic and engagement in preventive strategies is rooted in threat estimations.

Specifically, we tested and confirmed that the model that assumes $\text{Threat}_{\text{Difference}}$ influences vaccine intention, which then influences the C_{Index} (CRs versus COs), is also empirically supported: the indirect effect of $\text{Threat}_{\text{Difference}}$ on categorical C_{Index}, mediated by the vaccine intention ($B = 0.09$, s.e. = 0.02, $p < 0.001$) was significant. The direct effect was also significant: $B = 0.11$, s.e. = 0.04, $p = 0.01$ and the total effect of $\text{Threat}_{\text{Difference}}$ on C_{Index} was $B = 0.19$, s.e. = 0.04, $p < 0.001$.

The model accounted for 6% of the variance of categorical C_{Index} and vaccine intention accounted for 45% of the total effect.

As the last exploratory analyses, we wanted to test whether $\text{Threat}_{\text{Difference}}$ explains the variance of vaccine intention beyond the fear of the vaccines ($\text{Threat}_{\text{Vaccine}}$).

To test this, we conducted a linear regression analysis, which included $\text{Threat}_{\text{Vaccine}}$ as a part of the 'null model' and then inspected the significance of R^2 change with the model including additional $\text{Threat}_{\text{Difference}}$. We ran separate analyses for comparative optimists and comparative realists.

In the case of COs, the model consisting of just $\text{Threat}_{\text{Vaccine}}$ accounted for 19% of the variance of vaccine intention. The model with additional $\text{Threat}_{\text{Difference}}$ accounted for 23% of the variance and the R^2 change was statistically significant: $R^2_{\text{Change}} = 0.04$, F_{Change} (1, 1055) = 60.87, $p < 0.001$.

In the case of CRs, $\text{Threat}_{\text{Vaccine}}$ accounted for 16% of the variance, while adding $\text{Threat}_{\text{Difference}}$ yielded 26% of explained variance. R^2 change was significant, $R^2_{\text{Change}} = 0.10$, F_{Change} (1, 300) = 40.76, $p < 0.001$. An analogical analysis comparing models with $\text{Threat}_{\text{Disease}}$ instead of $\text{Threat}_{\text{Vaccine}}$ can be found in the OSF folder.

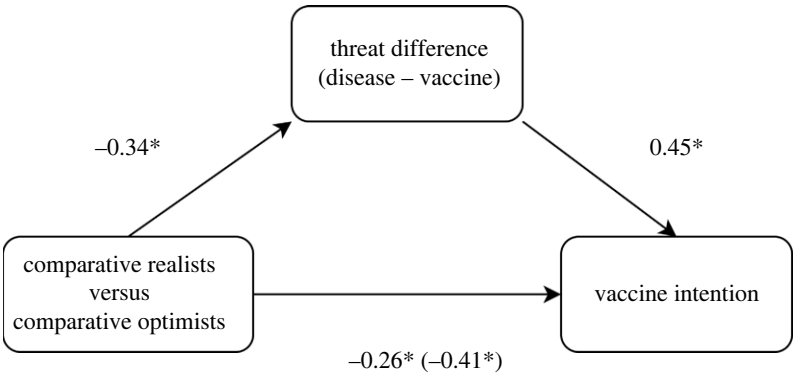


Figure 6. Path plot for mediation model with 'vaccine intention' as the dependent variable, categorical C_{Index} (CRs versus COs) as a predictor and $Threat_{Difference}$ as a mediator.

4.3. Discussion

The study provided evidence that realists and vaccine-hesitant people had at least two shared traits: they hold stronger beliefs about vaccines being developed too quickly and they assign different weights to threats from the COVID-19 disease and vaccine: vaccine-hesitant and comparative realists are less afraid of the disease and more afraid of the vaccine.

One plausible theoretical explanation for these commonalities comes from protection motivation theory (PMT [47]). In the PMT model, changes in attitudes and behaviours are driven by the fear of negative consequences of current behaviour. In this model, attitude or behaviour change is caused by individuals' perception of three domains:

(1) severity of negative consequences of maintaining the current state,
(2) probability of negative consequences of maintaining the current state, and
(3) efficacy of the considered alternative.

When it comes to vaccination, one additional factor seems to be at play—fear of the negative outcomes of the vaccine itself, and this is where the recent expansion of the PMT is needed [48]. In the PMT expansion, a fourth and fifth dimension are considered:

(4) severity of negative consequences of the alternative behaviour, and
(5) probability of negative consequences of the alternative behaviour.

In this framework, when an individual considers any preventive, anti-COVID-19 measure (be it vaccination or mask wearing), their final decision would be positive if: (i) they are convinced that the negative outcomes of changing nothing and living as 'usual' will be dreadful, (ii) they are quite sure that they will face these consequences, (iii) they believe preventive measures can actually work, and (iv) they believe that the preventive measures bear no significant risk to themselves.

Extended PMT theory can also explain why vaccine intention mediates the relationship between $Threat_{Difference}$ and comparative bias. In that framework, people become comparative optimists due to the measures they take, and they take these measures because they believe that they can outweigh the potential harm from COVID-19. Comparative realists, on the other hand, are aware of their disengagement, and this disengagement might be born out of the equilibrium of threats they perceive from the disease and the cure.

5. General discussion

Comparative optimism is a robust phenomenon. The bias proved to be present inter-contextually [46], and since the first theoretical works in the 1980s, it is still considered a replicable and practically significant effect. Furthermore, the bias has been successfully discovered by multiple research teams in many settings during the COVID-19 pandemic [49–51]. But do social psychologists have a firm understanding of why this bias occurs and its consequences?

As with many other collective irrationalities, we can too often be taken in by the 'rational = desirable' narrative. In such a narrative we implicitly or explicitly assume that the most desirable state would be 'unbiased', and, if the examined population fails to adhere to this pattern, we conclude that the cognitive processes we examine are somewhat 'flawed'. In the presented studies, we concluded that those who are 'unbiased' more often abstain from taking one of the most (if not *the* most) effective, evidence based and affordable actions that could protect them from deadly threat. A seemingly 'rational' mental approach to the issue of COVID-19 contraction is related to a more irrational response to that threat—namely not getting vaccinated.

In the mini meta-analysis and two pre-registered studies, we discovered that those who express either comparative pessimism or optimism have a higher intention to get vaccinated for COVID-19 than those who are unbiased. The relationship of comparative pessimism to pro-health behaviour seems more intuitive, and the positive relationship of comparative optimism comes as a surprise, but our discovery is not isolated in that regard [52].

In Study 2, we found no evidence of a relationship between psychological control and comparative optimism with vaccine intention.

In Study 3 we found a common denominator of people who are realists and who have a lower vaccine intention. It turned out that both phenomena are related to lower COVID-19 $\text{Threat}_{\text{Difference}}$ ($\text{Threat}_{\text{Disease}} - \text{Threat}_{\text{Vaccine}}$). Furthermore, in line with the extended protection motivation theory (PMT [47,48]), the trade-off between risks of the disease and risks of the vaccine proved to predict being unbiased, and this relationship is partly mediated by vaccine intention.

Our studies present evidence that counters the 'rational = desirable' narrative, but that could lead into another trap: assuming that it is irrationalities and biases that help us cope more effectively. We think that such a narrative can be an equally false over-simplification and our studies offer more compelling explanations.

Collective irrationalities, such as comparative optimism may neither enhance nor hamper our coping abilities. They may, in turn, be a by-product of ongoing coping processes, possibly leading to greater protection (in the case of our studies, vaccination against COVID-19). From the perspective of our studies, it is clear that we might wrongfully ascribe a causal role to these biases.

While one might think that comparative optimism may cause reckless behaviour, such as refusal to vaccinate, Study 3 suggests another plausible alternative mechanism: $\text{Threat}_{\text{Difference}}$ might be the reason for stronger or weaker vaccine intention (along with many other factors; see [43,53]) and comparative optimism might be a result of knowing one's own efforts, such as vaccination. In fact, a recent experimental study [52] provides evidence that being more aware of one's own self-protective effort enhances comparative optimism.

It is also noteworthy that comparative biases may arise in part from a lack of information about the comparative target, and that providing people with information about the comparative target diminishes the bias [54]. Accordingly, the comparative optimists in our study may have lacked information about the preventive behaviour of others.

The case of the relationship between comparative optimism and constructive pro-health behaviour is complex. On the one hand, we have evidence for both the benefits and drawbacks of CO [55]. On the other hand, CO may be the result rather than the cause of pro-health behaviour. Clearly there are many contextual factors involved and we should discard the overly simplistic view of an inherently beneficial or inherently harmful nature of comparative optimism (which also might be the case for many other collective irrationalities).

Our paper presents a pre-registered and high-powered line of research, which addresses differences between comparative optimists and the 'unbiased'—a category of individuals that has most often been either left undiscussed or barely mentioned in previous studies regarding CO. Examining the bias from the perspective of the unbiased and using a mixed method approach that combined theory-driven hypotheses with a bottom-up strategy, thus giving a voice to participants, offered the opportunity to enrich theoretical knowledge on comparative bias and led to the surprising discovery that being unbiased can be related to a less pro-health attitude.

5.1. Limitations and future directions

The main limitation of our study is the lack of behavioural measures. This was a result of an early stage of our research project, which took place before COVID-19 vaccines were available. For that reason, we gathered data only about vaccine intention. In follow-up studies the vaccines were available but we decided to examine the intention of the yet unvaccinated to ensure the direct comparability of follow-

up studies with the studies from a mini meta-analysis. This limitation leads to another one—at the time of Study 2 and especially Study 3, the number of unvaccinated was shrinking and we can expect that they might differ from the general population in many ways (for example, from study to study, we observed the diminishing share of 'realists'). This constitutes a limit for the generalization of our conclusions.

The future direction of research regarding the differences between unbiased and comparative optimists should concentrate on actual behaviours rather than intentions or declarations. Moreover, future studies should enhance the scope of generalization by investigating more representative samples.

Another limitation is the possibility of an alternative explanation of our results. We interpret the results of Study 3 in the light of the extended PMT theory, assuming that the relationship between predicted outcomes of falling ill and getting vaccinated leads to engagement or disengagement with vaccination, which it turn results in them feeling superior (comparatively optimistic) or similar (comparatively realistic) to others.

But an alternative is probable. Following Gigerenzer's theory of 'fast and frugal heuristics' [56], people can often make more ecologically valid decisions when they follow heuristics, without engaging in deep, analytical processes.

Perhaps people who chose the ecologically rational option to take the vaccine did so because they followed their intuition/shortcuts when making the decision. By doing so, they estimated the trade-offs between the disease and vaccine in line with the mainstream message (media, experts and authorities). If these individuals followed intuition in this respect, they may also be more prone to the default bias, namely optimistic bias. On the other hand, people who engage in processing the information more reflectively might end up being more sceptical towards vaccination and also less prone to the optimistic bias.

These alternative explanations could be empirically tested—if pro-vaccine attitudes could be ascribed to using more 'fast and frugal heuristics', people more sceptical of the vaccines should be able to recall more information about vaccines (regardless of their epistemic status) and provide more elaborate explanations for their stance.

As a general direction for future research on comparative biases, we advocate for considering a categorical approach to measuring biases—individuals who do not exhibit a bias should be treated as a separate category, especially when empirical results would indicate a substantial inflation of scores signalling a lack of bias (a similar inflation has been identified in the case of dehumanization—see [57], p. 12). Alternatively, if one decides to treat comparative bias as a continuous scale, a nonlinear relationship should be investigated. If comparative biases can have two directions, it is reasonable to expect that different directions might have different correlations.

Ethics. All studies have been approved by SWPS University of Social Sciences and Humanities, Wrocław Faculty of Psychology ethics committee.

Data accessibility. All data, reproducible analyses files and study materials can be accessed in Open Science Framework public repository: https://osf.io/skc5d/.

Authors' contributions. K.I.: conceptualization, formal analysis, investigation, methodology, visualization, writing—original draft, writing—review and editing; D.D.: conceptualization, funding acquisition, investigation, supervision, validation, writing—review and editing; O.G.: conceptualization, investigation, methodology, validation, writing—review and editing; W.K.: funding acquisition, validation, writing—review and editing; P.M.: formal analysis, validation, writing—review and editing; B.G.S.C.: formal analysis, investigation, writing—original draft, writing—review and editing; C.S.: conceptualization, investigation, methodology, supervision, validation, writing—review and editing.

All authors gave final approval for publication and agreed to be held accountable for the work performed therein.

Conflict of interest declaration. Authors declare no conflict of interest regarding this work.

Funding. This research was supported by grants: 1. RID(Regionalna Inicjatywa Doskonałości Mazowsza—Regional Excellence Initiative for Masovian District—https://www.gov.pl/web/edukacja-i-nauka/regionalna-inicjatywa-doskonalosci): 'Unrealistic optimism in the age of pandemic. Health research and ensuring safety for the inhabitants of Mazovia district' granted to D.D. (2020/2). 2. The Polish National Agency for Academic Exchange (NAWA—https://nawa.gov.pl/) within the Urgency Grants programme granted to W.K. (number: PPN/GIN/2020/1/00063/U/00001).

References

1. Ritchie S. 2020 *Don't trust the psychologists on coronavirus*. UnHerd. https://unherd.com/2020/03/dont-trust-the-psychologists-on-coronavirus/
2. Sunstein CR. 2020 *The cognitive bias that makes us panic about coronavirus*. Bloomberg.Com. https://www.bloomberg.com/opinion/articles/2020-02-28/coronavirus-panic-caused-by-probability-neglect
3. Gigerenzer G. 2020 *Why What Does Not Kill Us Makes Us Panic*. Project Syndicate. https://www.project-syndicate.org/commentary/greater-risk-literacy-can-reduce-coronavirus-fear-by-gerd-gigerenzer-2020-03
4. Festinger L. 1954 A theory of social comparison processes. *Hum. Relat.* **7**, 117–140. (doi:10.1177/001872675400700202)

5. Weinstein ND. 1980 Unrealistic optimism about future life events. *J. Pers. Soc. Psychol.* **39**, 806–820. (doi:10.1037/0022-3514.39.5.806)
6. Perloff LS, Fetzer BK. 1986 Self–other judgments and perceived vulnerability to victimization. *J. Pers. Soc. Psychol.* **50**, 502–510. (doi:10.1037/0022-3514.50.3.502)
7. Weinstein ND. 1984 Why it won't happen to me: perceptions of risk factors and susceptibility. *Health Psychol.* **3**, 431–457. (doi:10.1037/0278-6133.3.5.431)
8. Weinstein ND. 1987 Unrealistic optimism about susceptibility to health problems: conclusions from a community-wide sample. *J. Behav. Med.* **10**, 481–500. (doi:10.1007/BF00846146)
9. Taylor SE, Brown JD. 1988 Illusion and well-being: a social psychological perspective on mental health. *Psychol. Bull.* **103**, 193–210. (doi:10.1037/0033-2909.103.2.193)
10. Hoorens V. 1995 Self-favoring biases, self-presentation, and the self-other asymmetry in social comparison. *J. Pers.* **63**, 793–817. (doi:10.1111/j.1467-6494.1995.tb00317.x)
11. Klein WMP, Weinstein ND. 1997 Social comparison and unrealistic optimism about personal risk. In *Health, coping, and well–being: perspectives from social comparison theory* (eds BP Buunk, FX Gibbons), pp. 25–61. Mahwah, NJ: Lawrence Erlbaum Associates Publishers.
12. Klein CTF, Helweg-Larsen M. 2002 Perceived control and the optimistic bias: a meta-analytic review. *Psychol. Health* **17**, 437–446. (doi:10.1080/0887044022000004920)
13. Taylor SE. 1989 *Positive illusions: creative self-deception and the healthy mind*. New York, NY: Basic Books/Hachette Book Group.
14. Dillard AJ, McCaul KD, Klein WMP. 2006 Unrealistic optimism in smokers: implications for smoking myth endorsement and self-protective motivation. *J. Health Commun.* **11**(sup001), 93–102. (doi:10.1080/10810730600637343)
15. Dillard AJ, Midboe AM, Klein WMP. 2009 The dark side of optimism: unrealistic optimism about problems with alcohol predicts subsequent negative event experiences. *Pers. Soc. Psychol. Bull.* **35**, 1540–1550. (doi:10.1177/0146167209343124)
16. Dolinski D, Gromski W, Zawisza E. 1987 Unrealistic pessimism. *J. Soc. Psychol.* **127**, 511–516. (doi:10.1080/00224545.1987.9713735)
17. Burger JM, Palmer ML. 1992 Changes in and generalisation of unrealistic optimism following experiences with stressful events: reactions to the 1989 California earthquake. *Pers. Soc. Psychol. Bull.* **18**, 39–43. (doi:10.1177/0146167292181006)
18. Shepperd JA, Ouellette JA, Fernandez JK. 1996 Abandoning unrealistic optimism: performance estimates and the temporal proximity of self-relevant feedback. *J. Pers. Soc. Psychol.* **70**, 844–855. (doi:10.1037/0022-3514.70.4.844)
19. Rutter DR, Quine L, Albery IP. 1998 Perceptions of risk in motorcyclists: unrealistic optimism, relative realism and predictions of behaviour. *Br. J. Psychol.* **89**, 681–696. (doi:10.1111/j.2044-8295.1998.tb02710.x)
20. Radcliffe NM, Klein WMP. 2002 Dispositional, unrealistic, and comparative optimism: differential relations with the knowledge and processing of risk information and beliefs about personal risk. *Pers. Soc. Psychol. Bull.* **28**, 836–846. (doi:10.1177/0146167202289012)
21. McColl K *et al.* 2022 Are people optimistically biased about the risk of COVID-19 infection? Lessons from the first wave of the pandemic in Europe. *Int. J. Environ. Res. Public Health* **19**, 436. (doi:10.3390/ijerph19010436)
22. Agarwal DK, Gelfand AE, Citron-Pousty S. 2002 Zero-inflated models with application to spatial count data. *Environ. Ecol. Stat.* **9**, 341–355. (doi:10.1023/A:1020910605990)
23. Green JA. 2021 Too many zeros and/or highly skewed? A tutorial on modelling health behaviour as count data with Poisson and negative binomial regression. *Health Psychol. Behav. Med.* **9**, 436–455. (doi:10.1080/21642850.2021.1920416)
24. Hu M-C, Pavlicova M, Nunes EV. 2011 Zero-inflated and hurdle models of count data with extra zeros: examples from an HIV-risk reduction intervention trial. *Am. J. Drug Alcohol Abuse* **37**, 367–375. (doi:10.3109/00952990.2011.597280)
25. Goh JX, Hall JA, Rosenthal R. 2016 Mini meta-analysis of your own studies: some arguments on why and a primer on how. *Soc. Personal. Psychol. Compass* **10**, 535–549. (doi:10.1111/spc3.12267)
26. JASP Team. 2020 *JASP (Version 0.14) [Computer software]*. See https://jasp-stats.org/.
27. Wolff K. 2021 COVID-19 vaccination intentions: the theory of planned behavior, optimistic bias, and anticipated regret. *Front. Psychol.* **12**, 648289. (doi:10.3389/fpsyg.2021.648289)
28. Prentice DA, Miller DT. 1992 When small effects are impressive. *Psychol. Bull.* **112**, 160–164. (doi:10.1037/0033-2909.112.1.160)
29. World Health Organization. 2019 *Ten health issues WHO will tackle this year*. See https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019.
30. Rotter JB. 1954 *Social learning and clinical psychology*. New York, NY: Prentice-Hall, Inc.
31. Sapp SG, Harrod WJ. 1993 Reliability and validity of a brief version of Levenson's locus of control scale. *Psychol. Rep.* **72**, 539–550. (doi:10.2466/pr0.1993.72.2.539)
32. Burger JM, Cooper HM. 1979 The desirability of control. *Motiv. Emot.* **3**, 381–393. (doi:10.1007/BF00994052)
33. McKenna FP. 1993 It won't happen to me: unrealistic optimism or illusion of control? *Br. J. Psychol.* **84**, 39–50. (doi:10.1111/j.2044-8295.1993.tb02461.x)
34. Hoorens V, Buunk BP. 1993 Social comparison of health risks: locus of control, the person-positivity bias, and unrealistic optimism. *J. Appl. Soc. Psychol.* **23**, 291–302. (doi:10.1111/j.1559-1816.1993.tb01088.x)
35. Bodenheimer HC, Fulton JP, Kramer PD. 1986 Acceptance of hepatitis B vaccine among hospital workers. *Am. J. Public Health* **76**, 252–255. (doi:10.2105/AJPH.76.3.252)
36. Paek H-J, Shin K-A, Park K. 2015 Determinants of caregivers' vaccination intention with respect to child age group: a cross-sectional survey in South Korea. *BMJ Open* **5**, e008342. (doi:10.1136/bmjopen-2015-008342)
37. Olagoke AA, Olagoke OO, Hughes AM. 2021 Intention to vaccinate against the novel 2019 coronavirus disease: the role of health locus of control and religiosity. *J. Religion Health* **60**, 65–80. (doi:10.1007/s10943-020-01090-9)
38. R Core Team. (2020). *R: a language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. See https://www.R-project.org/.
39. Lee MD, Wagenmakers E-J. 2014 *Bayesian cognitive modeling: a practical course*. Cambridge, UK: Cambridge University Press.
40. Roberts ME, Stewart BM, Tingley D. 2019 stm: an R package for structural topic models. *J. Stat. Softw.* **91**, 1–40. (doi:10.18637/jss.v091.i02)
41. Wallach HM, Murray I, Salakhutdinov R, Mimno D. 2009 Evaluation methods for topic models. In *Proc. of the 26th Annual Int. Conf. on Machine Learning*, pp. 1105–1112.
42. Amit Aharon A, Nehama H, Rishpon S, Baron-Epel O. 2018 A path analysis model suggesting the association between health locus of control and compliance with childhood vaccinations. *Hum. Vaccines & Immunother.* **14**, 1618–1625. (doi:10.1080/21645515.2018.1471305)
43. Murphy J *et al.* 2021 Psychological characteristics associated with Covid-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. *Nat. Commun.* **12**, 29. (doi:10.1038/s41467-020-20226-9)
44. Nexøe J, Kragstrup J, Søgaard J. 1999 Decision on influenza vaccination among the elderly: a questionnaire study based on the Health Belief Model and the Multidimensional Locus of Control Theory. *Scand. J. Prim. Health Care* **17**, 105–110. (doi:10.1080/028134399750002737)
45. Gerretsen P *et al.* 2021 Individual determinants of COVID-19 vaccine hesitancy. *PLoS ONE* **16**, e0258462. (doi:10.1371/journal.pone.0258462)
46. Shepperd JA, Waters E, Weinstein ND, Klein WMP. 2015 A primer on unrealistic optimism. *Curr. Dir. Psychol. Sci.* **24**, 232–237. (doi:10.1177/0963721414568341)
47. Rogers RW. 1975 A protection motivation theory of fear appeals and attitude change1. *J. Psychol.* **91**, 93–114. (doi:10.1080/00223980.1975.9915803)
48. Cummings CL, Rosenthal S, Kong WY. 2021 Secondary risk theory: validation of a novel model of protection motivation. *Risk Anal.* **41**, 204–220. (doi:10.1111/risa.13573)
49. Druică E, Musso F, Ianole-Călin R. 2020 Optimism bias during the Covid-19 pandemic: empirical evidence from Romania and Italy. *Games* **11**, 39. (doi:10.3390/g11030039)
50. Kuper-Smith BJ, Doppelhofer LM, Oganian Y, Rosenblau G, Korn CW. 2021 Risk perception and optimism during the early stages of the Covid-19 pandemic. *R. Soc. Open Sci.* **8**, 210904. (doi:10.1098/rsos.210904)
51. Salgado S, Berntsen D. 2021 'It won't happen to us': unrealistic optimism affects COVID-19 risk assessments and attitudes regarding protective behaviour. *J. Appl. Res. Mem. Cogn.* **10**, 368–380. (doi:10.1016/j.jarmac.2021.07.006)

52. Vieites Y, Ramos GA, Andrade EB, Pereira C, Medeiros A. 2021 Can self-protective behaviors increase unrealistic optimism? Evidence from the COVID-19 pandemic. *J. Exp. Psychol.: Appl.* **27**, 621–631. (doi:10.1037/xap0000379)
53. Senger AR, Huynh HP. 2021 Intellectual humility's association with vaccine attitudes and intentions. *Psychol. Health Med.* **26**, 1053–1062. (doi:10.1080/13548506.2020.1778753)
54. Kruger J, Windschitl PD, Burrus J, Fessel F, Chambers JR. 2008 The rational side of egocentrism in social comparisons. *J. Exp. Soc. Psychol.* **44**, 220–232. (doi:10.1016/j.jesp.2007.04.001)
55. Shepperd JA, Pogge G, Howell JL. 2017 Assessing the consequences of unrealistic optimism: challenges and recommendations. *Conscious Cogn.* **50**, 69–78. (doi:10.1016/j.concog.2016.07.004)
56. Gigerenzer G, Todd PM. 1999 *Simple heuristics that make us smart*. Oxford, UK: Oxford University Press.
57. Izydorczak K, Grzyb T, Dolinski D. 2022 Ascent of humans: investigating methodological and ethical concerns about the measurement. *Collabra: Psychol.* **8**, 33297. (doi:10.1525/collabra.33297)

Artykuł 4 – Vaccine skeptics and vaccine enthusiasts: What is the intergroup wall made of?

Vaccine Skeptics and Vaccine Enthusiasts: What is the Intergroup Wall Made of?

Introduction

On June 21, 2022, news of the first case of Polio in the US in nearly a decade hit the media (Archie, 2022). A single case may not signal a trend, but it has symbolic significance – another effort to eradicate an infectious disease seems to be coming to naught. America, which was declared polio-free in 1994, is no longer so. Similarly, the measles eradication program has been facing serious problems for some time. Cases of the disease have been rising rapidly worldwide since 2016 (*Reported Cases of Measles*, 2022) and in the first two months of 2022 the number of cases was 79% higher compared to the same period in 2021. (*Measles Outbreaks, Affecting Children*, n.d.).

The failure of efforts to eliminate vaccine-preventable diseases is commonly attributed to vaccine hesitancy: a personal attitude that leads people to postpone or neglect vaccinations for themselves or their children, even when vaccinations are available and inexpensive/free. (MacDonald, 2015). Vaccine hesitancy became a particularly vivid issue during the COVID-19 pandemic.

At the time, we witnessed an unprecedented event in human history: A vaccine for a deadly and highly contagious disease was developed and marketed less than a year after the official announcement of the pandemic.

This unique achievement of science and international cooperation has given us a prospect of stopping the spread of a contagious disease that has claimed 6.4 million lives (by 23.07.2022—*COVID Live – Coronavirus Statistics—Worldometer*, n.d.) and shaken the world economy. However, this hope has not fully materialized. Even in high-income countries where

vaccines are available to all, less than 70% of eligible citizens are fully vaccinated. In low-income countries, the percentage fully vaccinated is less than 16% (Mathieu et al., 2021).

With this context in mind, convincing vaccine-hesitant individuals appears to be one of the most critical tasks for our societies. Even before the COVID-19 pandemic, WHO has identified vaccine hesitance as one of the top-ten global health threats (*Ten Health Issues WHO Will Tackle This Year*, n.d.).

Unfortunately, the task is as important as it is difficult. Part of the problem is the multifaceted nature of vaccination hesitancy—the reasons for not vaccinating can be very complex and vary from country to country and culture to culture.

The goal of the study is to investigate one possible reason why the effective communication and persuasion of the vaccine-hesitant might be hindered. The factor in question is the mutual negative attitudes between the vaccine-skeptic and vaccine-enthusiast social groups. In our study, we intend to test whether vaccine-skeptics and vaccine-enthusiasts dehumanize each other, and if so, to what extent this phenomenon is global.

Vaccine Hesitancy and Group Identity

We may be inclined to assume that people reluctant to vaccinate either lack credible information or cannot correctly assess the objective state of scientific knowledge and make a logically consequential decision. While this interpretation may be prevalent and seems to be an implicit assumption in many online and offline debates, science communicators frequently criticize it.

Wynne (1991) was one of the first to speak out against this. He called this explanation the "cognitive deficit model" and proposed that instead, we should understand the rejection of

scientific knowledge through the lens of the social context, most importantly the context of social identity (Wynne, 1992). What people reject, is not necessarily the content of scientific knowledge itself or the method through which it was obtained. Instead, according to Wynne (1992), people reject the messengers of that knowledge, as they perceive them as outsiders whose interests do not coincide with those of their in-group.

Wynne's thought was repeated, elaborated and brought into the specific context of vaccine hesitancy by Hornsey and Fielding (2017). In this work, the authors postulate the search for many motivational roots of rejecting scientific knowledge. One such reason is the motivation to maintain and act on one's social identity. Another source, closely related to social identity, is ideology/value system.

In this vein, the authors argue that the rejection of the HPV vaccine is partly rooted in an aversion to more progressive social norms. Since the HPV vaccine is mainly recommended for adolescent women (preferably before they become sexually active), the decision to vaccinate rests on the shoulders of parents. They must face the realistic prospect that their daughters will soon become sexually active, presumably with multiple partners. Since this could threaten the parents' preferred values and traditional social order, they become reluctant to vaccinate.

A number of recent empirical studies support the claim that aversion to vaccination is closely linked to broader beliefs and value system that can easily translate into group identity and group affiliation. Much evidence suggests that aversion to vaccination is linked to conservatism and a conspiratorial worldview (Freeman et al., 2020; Hornsey et al., 2020; Stroope et al., 2021). Moreover, analyses of vaccine-related online activity reveal that Russian state-driven disinformation about vaccines specifically exploits existing intergroup (e.g.,

interracial) tensions. These disinformation activities often aim to radicalize both sides of the conflict (Broniatowski et al., 2018, 2020; Walter et al., 2020).

The question of pro- and anti-vaccine group identity has also been addressed more directly. Maciuszek and colleagues (Maciuszek et al., 2021) studied a targeted sample of individuals who hold pro- or anti-vaccine attitudes and are involved in discussions about vaccines. Representatives of both attitudes manifested a sense of group identity based on their positions on vaccines. Interestingly, pro-vaccine respondents had a stronger group identity and it manifested itself in all measured domains (Importance, Commitment, Superiority and Deference).

Intergroup Attitudes and Mutual Dehumanization Between Vaccine Sceptics and Vaccine Enthusiasts

Despite many theoretical and empirical suggestions that attitudes toward vaccines may shape (or at least be part of) group identities, there is little research that directly examines how pro- and anti-vaccine people view each other. This issue may be crucial for understanding and mitigating communication barriers between groups.

In the domain of intergroup relations, social psychologists often emphasize the prevalence and importance of various forms of so-called dehumanization (see: Haslam, 2015 for a synthetic overview). Dehumanization occurs when a member of one group (typically in-group) denies the existence of some or all of the prototypical human characteristics of another group (typically out-group).

The occurrence of dehumanization or meta-dehumanization (the feeling of being dehumanized) predicts many negative consequences in intergroup relations (see: Kteily &

Landry, 2022 for a recent review).

From available knowledge, it appears that pro- and anti-vaccine individuals can form groups that are prone to polarization and mutual hostility. Mønsted and Lehmann (2022) found that the pattern of online interactions regarding vaccines reveals an "epistemic echo chamber" effect for both pro- and anti-vaccine individuals. These two groups form an internally consistent information environment, supporting their attitudes and rarely interacting with content expressing opposing views.

There are evidence suggesting that vaccine averse individuals may be *animalistically dehumanized* by vaccine supporters. *Animalistic dehumanization* (or denial of *human uniqueness*) is part of the dual dehumanization model proposed by Haslam (2006). It occurs when someone is denied traits that distinguish humans from animals. These traits are related to self-control, high cognitive functions or cultural sophistication.

Rozbroj and colleagues (2022) found that similar qualities are denied to vaccine-skeptics – they tend to be perceived as intellectually inferior, overly emotional and disruptive by vaccine-enthusiasts. In addition, Maciuszek and colleagues (2021) found that pro-vaccine people tend to view anti-vaccine people as lacking in scientific knowledge.

Analogically, pro-vaccine people may experience *mechanistic dehumanization* from anti-vaccine people. Mechanistic dehumanization (or denial of *human nature*) is the second part of Haslam's dual model of dehumanization. It involves denying someone the traits associated with *human nature* that separate humans from inanimate entities such as robots. These traits refer to virtues such as warmth, empathy or individuality/agency.

Rozbroj and Collegues (Rozbroj et al., 2022) found that people who actively refuse

vaccination perceive themselves as rich in virtues that closely resemble the *human nature* constellation from the dual dehumanization model. They see themselves as courageous, caring (for example, for their children) and independent. Moreover, an analysis of vaccine skeptic's narratives in online media, revealed that anti-vaccine attitudes are promoted with motives of freedom, individual agency and care (Jamison et al., 2020; Lander & Ragusa, 2021).

Since anti-vaccine individuals see themselves as a minority possessing *human nature* traits and are additionally surrounded by narratives that support their view, a logical consequence could be the negation of *human nature* traits in the opposing group—vaccine enthusiasts.

Another type of dehumanization, which can involve the relationship between vaccine skeptics and vaccine enthusiasts, is *blatant dehumanization* (Kteily et al., 2015). This concept of dehumanization is one of the most comprehensive. It does not specify what human-related properties are being denied. Instead, it invokes the simple notion of being/not being a fully evolved/developed human being.

This type of dehumanization has been shown to be loosely correlated with more subtle forms (such as *dual-model dehumanization*) and closely linked to general prejudice and hostility toward the dehumanized external group (Kteily & Landry, 2022).

Since blatant dehumanization is a good indicator of general hostility, we predict that vaccine enthusiasts may tend to blatantly dehumanize vaccine skeptics. What's more, the vaccine-skeptics will feel blatantly dehumanized by the opposing group (meta-dehumanization).

Rozbroj and Collegues (2019) found that pro-vaccine people maintain highly hostile attitudes toward vaccine skeptics. Here are some excerpts from the opinions about vaccine

refusers: “A bunch of misinformed, dangerous twits”, “Deluded paranoid narcissists!”, “A selfish group of deliberately ignorant people” (Rozbroj et al., 2019, p. 5988).

Such opinions are reflected in the accounts of parents who refuse vaccinations. A qualitative study by Wiley and colleagues (2021) found that parents who refuse vaccinations experience labeling, social exclusion and loss of status. In their perspective, these adversities are a consequence of their virtues and best intentions, and as such are unfair and cruel. Such a perspective can provide good ground for a sense of being dehumanized. This feeling may be stronger in people who frequently come into contact with vaccination enthusiasts.

The Goal of the Study

The goal of the study is to empirically verify the predictions concerning mutual dehumanization between vaccine enthusiasts and vaccine skeptics.Whe theoretical basis for them was presented in previous chapters. The hypotheses are:

H1. Vaccine enthusiasts will animalistically dehumanize vaccine skeptics,

H2. Vaccine skeptics will mechanistically dehumanize vaccine enthusiasts,

H3. Vaccine enthusiasts will blatantly dehumanize vaccine skeptics,

H4a. Vaccine skeptics will experience meta dehumanization (They will believe, they are blatantly dehumanized by pro-vaccine people.)

H4b. In the relationship predicted in hypothesis H4a, the intensity of an online-interactions with vaccine enthusiasts will be a significant covariate—The effect of meta-dehumanization will be stronger in the case of the respondents who have more interaction with pro-vaccine people.

We tested these hypotheses on three separate populations - South African, Polish and

American – to establish to what degree postulated effects can be universal vs. local. It is a crucial point of our investigation since most of the empirical works on which we base our predictions, were conducted in North America or Australia. This may pose a serious problem for generalizability, since the political and social discourse around vaccines can be highly-specific in different countries - see the reviews of such local contexts in South Africa (Bam, 2021) and Poland (Żuk et al., 2019).

Method

We conducted an online, correlational study, using targeted sampling. The study was be pre-registered. Data, methods and reproducible analyses are publicly available through the OSF platform (https://osf.io/67h3w/?view_only=9146ef931c1c48cfa64fd2fc7c5e3f06).

We conducted both confirmatory and exploratory analyses, with key areas of exploration assumed beforehand.

Deviations from Pre-registered Protocol

During the data collection process, we were forced to deviate from the pre-registered protocol in two minor ways:

1. We planned to recruit all respondents from a single, multinational online panel - Prolific. This turned out to be impossible because there were not enough Polish participants with negative attitudes towards COVID-19 vaccines available on this panel. To alleviate this problem, we decided to obtain additional Polish participants with negative attitudes through the Polish research panel.

2. Due to resource constraints, the Prolific sample size was slightly smaller than our original target. Out of the planned 400 participants per country, we were able to recruit 383

participants from South Africa and 397 participants from the United States. In contrast, we were able to recruit more Polish participants than originally planned (482). This was due to the additional sourcing from the second panel. We decided to retain this excess data in order to maximize the cost-effectiveness of the research.

Participants and Data Gathering

We sourced our participants through the Prolific platform, using pre-screen criteria and gender-balancing to obtain the sample of the desired characteristics. We chose Prolific because of its high diversity of participants and advanced tools for customizing the sample characteristics. Additionally, we sourced the participants from local, Polish research panel, using the same pre-screen criteria and gender-balancing.

The first desired characteristics were nationalities and locations. We collected samples from three locations and nationalities:

- Participants located in South Africa and of South-African nationality,
- Participants located in Poland and of Polish nationality,
- Participants were located in the USA and of American nationality.

Besides the cultural differences, these three clusters of participants form a pool that is diverse geographically (three continents), socially (a post-colonial society, a post-communist society and a Western democratic society) and economically (respectively 103, 41 and 7 places in the world ranking of GPD per capita at purchasing power parity ((*World Economic Outlook (October 2022)*, n.d.))).

The second characteristic of our sample which we chose to control was the attitude towards vaccinations. We sources participants that stated a firm opinion on the Prolific panel

pre-screen question: *Please describe your attitudes towards the COVID-19 (Coronavirus) vaccines.* For each national/regional cluster, we plan to recruit participants who responded either “Against (I feel negatively about the vaccines)” or “For (I feel positively about the vaccines)” in a 50%/50% proportion.

Thirdly, all three regional/national clusters were balanced on the sex criteria with a 50%/50% men and woman proportion (the only available balancing option on the platform).

Sample Size Justification

Planning our sample size, we chose a test for the hypothesis H2: *Vaccine-enthusiasts will blatantly dehumanize vaccine-skeptics* as a point of reference. To define a minimal effect size of interest, we examined a recent, publicly available data set containing a measure of blatant dehumanization (Izydorczak et al., 2022). In this data set, a Polish sample of participants responded to a blatant dehumanization item concerning their national in-group and various out-groups.

Following the authors' advice to consider the dichotomic cut-off point (“full humanity”, “non-full humanity”) as the most essential score, we compared the proportion of “full humanity”/” non-full-humanity” scores for the ingroup and the “Russians” outgroup. Russians were chosen, because out of all outgroups who were negatively perceived in the aforementioned study, they were dehumanized to the least degree.

To detect the effect size, we conducted a mixed-model logistic regression for the binomial distribution with dichotomized blatant dehumanization (full humanity/non-full humanity) as an outcome, group of reference (Poles vs. Russians) as a fixed factor and participant ID as a random factor for intercepts. The probability of Poles being blatantly

dehumanized was .56, and the probability of Russians being blatantly dehumanized was .79 (OR = 2.9, 95% CI [2.24, 3.76], $p < .001$).

Using G*power, ver. 3.1.9.4, we concluded that to detect such effect size with the power 1-β = .95 and α = .05 we need a sample of 184 participants (a-priori analysis for *z*-test, logistic regression, one-tail, OR = 2.9, Pr(H0) = .56).

Considering this calculation, we need at least 184 vaccine-enthusiast participants for each three national/regional clusters. Analogically, we need the same number of vaccine-skeptical participants.

Taking possible data exclusions into account, we aim to recruit a 220 x 2 (vaccine-skeptical/vaccine-enthusiastic) x 3 (South-Africa, Poland, USA) = 1320 participants.

Inclusion and Exclusion Criteria

We included participants, who:

1) Met any of the convergent location/nationality criteria:
    a. Were located in South Africa and had South African nationality,
    b. Were located in Poland and had Polish nationality,
    c. Were located in the USA and have an American nationality,
2) Met language-comprehension criteria:
    a. The USA and South-Africa-based participants had to be fluent English-language users
    b. Poland-based participants had to be fluent Polish-language users.,
3) Met our pre-screening criteria regarding attitudes towards COVID-19 vaccines:
    a. Respond either “Against (I feel negatively about the vaccines)”, or

b. "For (I feel positively about the vaccines)" to the question: *Please describe your attitudes towards the COVID-19 (Coronavirus) vaccines.*

All inclusion criteria were implemented through internal pre-screening offered by Prolific or through filters within the questionnaire (in the case of participants sourced from the local Polish panel). While Prolific platform allows researchers to filter respondents invited to participate based on their responses to an internal demographic questionnaire, Polish local panel did not offer this option. For than reasons, screeners had to be added manually, using survey engine.

Additionally, we planned to exclude participants who would met at least one of the following condition:

1. Fail the bot-detection check ("I am not a robot" re-CAPTCHA test),
2. Indicate a different answer in a pre-screening question: *Please describe your attitudes towards the COVID-19 (Coronavirus) vaccines.,* which we will incorporate as a screener-check in our questionnaire,
3. Finish the survey extremely fast (less than one second per item),
4. Fail both of the attention check questions

Measurements and Procedure

We used Qualtrics to design an online survey. The survey consisted of 5 blocks: 1) Vaccine attitudes block, 2) blatant dehumanization, 3) dual model dehumanization, 4) human/animal words-based dehumanization, and 5) in-group and intergroup communication and attitudes. Block 1 was displayed as the first, block 5 as the last one. The order of display for blocks 2-4 was randomized. In multi-item blocks, the order of items was randomized as well.

Demographic data were delivered by Prolific and local, Polish research panel. Collected information were age, sex, fluent languages, ethnicity, country of birth, country of residence, nationality, native language, student status, and employment status.

In block 3 we included the first attention check question:

How typical do you think the listed trait is for the Pacific Ocean:

It contains water: (Answers 1- *not at all typical*, 2- r*ather untypical*, 3 - *rather typical*, 4- *completely typical*). Answers 1 and 2 will be considered failed attention check.

In block 5 we included the second attention check question:

When asked about your favorite color please indicate "blue". This is an attention check.

Name your favorite color: (Answers: blue, red, yellow, green).

Vaccine Attitudes.

In the vaccine attitudes block, participants were asked two questions. The first question is a direct reiteration of a pre-screening question. If the participant provided an answer which is inconsistent with the pre-screened data, they automatically were filtered out of the sample.

1) *Please describe your attitudes towards the COVID-19 (Coronavirus) vaccines.* With four possible answers: *Against (I feel negatively about the vaccines)*, *For (I feel positively about the vaccines)*, *Neutral (I don't have strong opinions either way)* and *Prefer not to say*.

The second question was analogical to the first one, but instead of asking about the COVID-19 vaccine, the question concerned attitudes about vaccines in general:

2) *Please describe your attitudes towards vaccines in general.* With four possible answers: *Against (I feel negatively about the vaccines)*, *For (I feel positively about the vaccines)*, *Neutral (I don't have strong opinions either way)* and *Prefer not to say*.

Blatant Dehumanization.

Blatant dehumanization was measured by the tool developed by Kteily et al. (2015). Participants read instructions (in Polish or English):

"Some people think that people can vary in how human-like they seem. According to this view, some people seem highly evolved, whereas others seem no different than lower animals. Using the sliders below, indicate how evolved you consider the group of people to be."

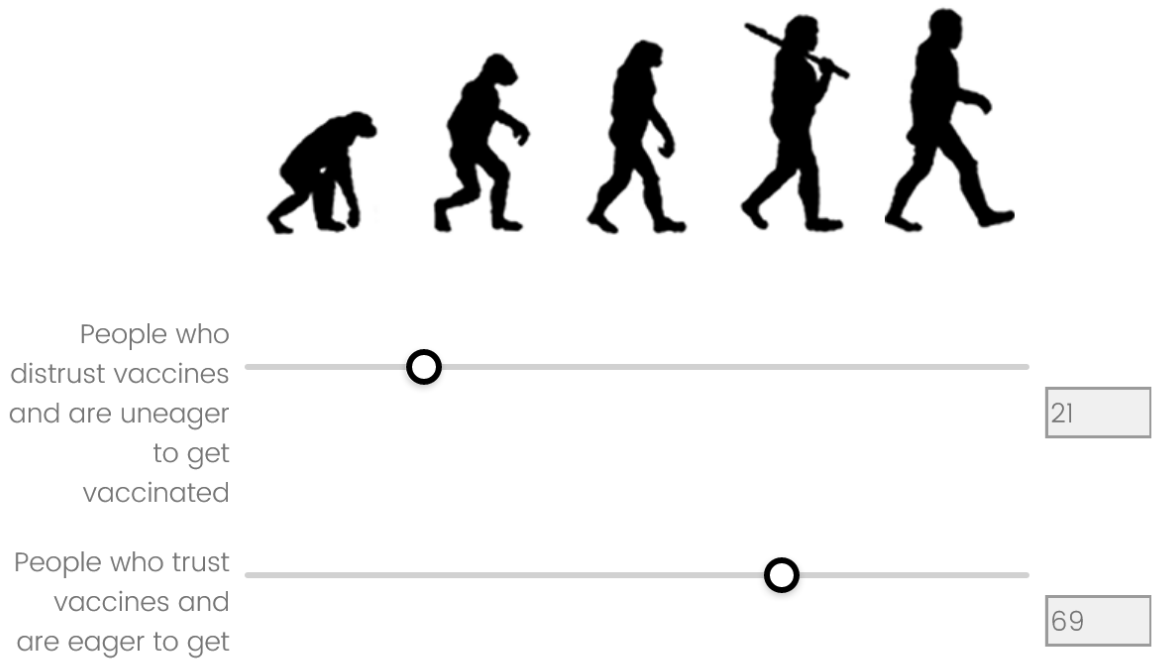
The questions was asked regarding two groups of people: "people who feel positive about vaccines and are eager to get vaccinated" and "people who feel negative about vaccines and are uneager to get vaccinated".

Participants rated their answers on a slider scale ranging from '0' to '100' (full humanity). The slider did not contain any numerical labels, the slider dot became visible upon a click on a slider scale, and the currently indicated numerical value was displayed under the slider dot. Above the slider scale, an illustration of 5 silhouettes which symbolize the evolution of the human species from quadrupedal animal to anatomically modern human was placed.

See the illustration below as an example.

Figure 1

Illustration of the Ascent of Humans Scale



Meta-dehumanization was assessed by the additional question: How do you imagine a typical [person with attitude opposite to the participant] would evaluate someone who is [attitude convergent with participants'] on this scale?

Dual-model Dehumanization.

Dual model dehumanization was assessed through Polish and English sets of 20 traits of which 10 pertained to the aspect of *human uniqueness* (traits which separate humans from animals) and 10 to the aspect of *human nature* (traits that separate humans from robots) - See Haslam (2011) for a detailed review of the theoretical concept behind the method. Two subsets contained an equal number (5 vs 5) of socially desirable and undesirable traits.

Both sets had been recently validated in the unpublished research in which the corresponding author was collaborating. In the validating study, the human uniqueness scale proved to be highly reliable in both Polish (Cronbach's $\alpha = 0.89$) and English sets (Cronbach's $\alpha = 0.84$). The same can be said about the human nature scale (Cronbach's $\alpha = 0.90$ for Polish set, Cronbach's $\alpha = 0.81$ for English set)

See supplementary materials for complete lists in both languages.

Respondents were asked three questions with respect to the listed traits:

1) How typical do you think each listed trait would be for the people who feel positive about vaccines and are eager to get vaccinated?

2) How typical do you think each listed trait would be for the people who feel negative about vaccines and are uneager to get vaccinated?

3) How do you imagine an average [person with an attitude opposite to the participant] would assess the typicality of these traits among those with [attitude convergent

with participants']?

Respondents were presented with a slider scale ranging from 0 to 100, labeled as '0 - not at all typical', '50 - somewhat typical' and '100 - very much typical'.

By averaging the answers for the traits in the respective sets, we calculated *human uniqueness*, *human nature*, *desirable traits* and *undesirable traits* scales.

Direct Dehumanization.

Direct dehumanization (Animal/human-related words) is a method of measuring dehumanization originally developed by Viki and colleagues (2006). In this method, participants are asked to indicate the extent to which they think certain words can be used to describe a given group or individual. The set of words contains two subsets—the words considered to be appropriate for describing animals and unfitting for humans and the words considered to be appropriate for describing humans and unfitting for animals. Respondents were presented with a set of 8 words, four of which were animal-related and four human-related.

The human/animal word list we used was recently validated in the unpublished study in which the corresponding author was collaborating. The human-words list had high internal consistency in both English (Cronbach's $\alpha = 0.83$) and Polish (Cronbach's $\alpha = 0.88$) versions. The animal-related word list had a moderate internal consistency in the English set (Cronbach's $\alpha = 0.73$) and very high in the Polish set (Cronbach's $\alpha = 0.90$)

Full sets for Polish and English languages can be found in Supplementary materials.

Participants were asked three questions about the word list:

1) Please indicate the extent to which you think each of the following words can be used to describe people who feel positive about vaccines and are eager to get vaccinated.

2) Please indicate the extent to which you think each of the following words can be used to describe people who feel negative about vaccines and are uneager to get vaccinated.

3) How do you imagine an average [person with an attitude opposite to the participant] would assess the extent to which the following words can be used to describe people who [attitude convergent with participants']?

Participants provided answers on a 0-100 slider scale, where 0 = *not at all* and 100 = *very much.*

In-group and Intergroup Communication and Attitudes.

To assess the extent to which a participant is engaged in debate with people expressing opposite attitudes towards vaccination, we asked the following questions:

1) Are you engaged in an online discussion with people who [attitude opposite to the participants] on the subject of vaccinations?

2) Are you engaged in real-life (offline) discussion with people who [attitude opposite to the participants] on the subject of vaccinations?

To assess the extent to which a participant is engaged in discourse with a group that shares their beliefs, we asked the following question:

3) Do you participate in online conversations with people who [attitude consistent with that of participants] about vaccination?

4) Do you participate in real-life (offline) conversations with people who [attitude consistent with that of participants] about vaccination?

Participants indicated their answers on a 0-100 slider scale, where 0 = *never* , 50 = *from time to time* and 100 = *on daily basis*.

As a measure of emotional attitude towards in-group and out-group, participants were asked to rate their feeling towards vaccine-skeptics and vaccine-enthusiasts in the form of feeling-thermometer slider scale:

5) 'How warm (favorable) or cold (unfavorable) do you feel towards the following groups?:

a. Vaccine enthusiasts,

b. Vaccine skeptics,

Answers were given on a 100-point scale slider-scale, where 0 = *very unfovorable* , 50 = *neutral* and 100 = *very favorable*.

Data Analysis

We conducted our analysis in Jamovi software, ver. 2.3.18. All confirmatory analyses were frequentist.

As the first step, we tested whether vaccine skeptics and vaccine-enthusiasts differentiate their emotional attitudes towards vaccine skeptics and vaccine-enthusiasts. .

Confirmatory Analyses.

In confirmatory analysis, all hypotheses were tested on three sub-samples simultaneously, including "country" as a random factor/cluster variable in the mixed-model analysis. Intracluster Correlation Coefficient (ICC) for "country" will be interpreted as a degree to which the obtained results are universal/country-specific.

To test the first hypothesis H1) *Vaccine-enthusiasts will animalistically dehumanize vaccine-skeptics,* we used a mixed-model linear regression (fixed slopes, random intercepts) with dehumanization index as a dependent variable, group of reference as fixed effect factor,

and “respondent ID” along with “country” as a random cluster variable.

Following the theoretical and empirical critique by Enock and colleagues (2021), we acknowledged that dual-model dehumanization might be confounded with a general positive bias towards in-group to a large extent.

To disentangle this possible confusion, we tested this hypothesis in two ways. The first way was the classic one: the dependent variable was a combined index of animal dehumanization. In the second variant, we tested two components/sub-scales of animalistic dehumanization separately: desirable *human uniqueness* and undesirable *human uniqueness*. This hypothesis was be tested on a group of vaccine-enthusiasts.

To second hypothesis, H2) *Vaccine-skeptics will mechanistically dehumanize vaccine-enthusiasts, was* tested in the same way as H1, but instead of vaccine enthusiasts, it was tested on the vaccine-skeptics group and instead of an animalistic dehumanization, the tested variables were: combined index of mechanistic dehumanization, desirable *human nature* and undesirable *human nature*.

To test the third hypothesis H3) *Vaccine-enthusiasts will blatantly dehumanize vaccine-skeptics,* we conducted a mixed-model logistic regression. We dichotomized the Ascent of Humans score (‘100’ score was be coded as “fully human”, scores < 100 were coded as “partially human”). This dichotomized score was the dependent variable. The reference group (*vaccine-enthusiasts* vs vaccine-skeptics*) was* a fixed factor while respondent ID and “country” were random factors for intercepts.

Fourth hypothesis H4a) Vaccine-skeptics *will experience meta-dehumanization (They will believe, they are blatantly dehumanized by pro-vaccine people.)* was tested analogically to H2) -

we conducted mixed-model logistic regression with dichotomized *Ascent of Humans* score as the dependent variable, a point of reference (self-evaluation of vaccine skeptics vs assumed evaluation of vaccine skeptics by vaccine enthusiasts) as a fixed factor and responded ID and "country" as a random factors for intercepts.

To test the H4b) - *In the relationship predicted in hypothesis H4a, the intensity of an online-interactions with vaccine enthusiasts will be a significant covariate - The effect of meta-dehumanization will be stronger in the case of the respondents who have more interaction with pro-vaccine people,* we conducted the same analysis as for the H4a) with one additional element: the intensity of the interactions with vaccine enthusiasts was assigned as a covariate.

Exploratory Analyses.

All tested relationships, as well as the distribution of the variables, were visually analyzed with additional statistical analysis..

Furthermore, In the exploratory section, we tested the occurrence of *blatant dehumanization*, *dual model dehumanization* and *meta dehumanization* in all remaining out-group/in-group combinations which were not investigated in the confirmatory section. Moreover we investigated the occurrence of direct dehumanization (Viki et al., 2006).

Results

Below we present the test of pre-registered hypotheses along with the post-hoc exploratory analyses. All data, scripts for data-wrangling and visualizations and reproducible statistical analyses (in .omv format) can be found in the OSF repository (https://osf.io/67h3w/?view_only=9146ef931c1c48cfa64fd2fc7c5e3f06).

For analyses we used Jamovi, ver. 2.3.18.0 (jamovi project, 2022), supported by

visualization and data processing in R programming language ver. 4.1.3 (R Core Team, 2022) with *tidyverse* (Wickham et al., 2019) and *ggstatsplot* (Patil, 2021) packages.

Participants' Characteristics - Demographics and Intergroup Relations

The final sample consisted of 1262 participants (630 women, 632 men, M_{Age} = 34.5, SD_{Age} = 13.3, Min_{Age} = 18, Max_{Age} = 82). Questions about COVID-19 vaccine attitude and attention checks were used as automated screeners, so no data exclusion has been made based on these criteria. All participants who passed the pre-screening criteria passed the bot-detection test as well. No data were excluded based on the completion time criterium. The detailed demographic characteristics of the sample are presented in the table below.

Table 1

Demographic Characteristics of Three National Samples

Nationality and residence	Sex	Attitude towards COVID-19 vaccine	Attitude towards vaccine (general)	Ethnicity	Employment status
Poland (n = 482)	Woman – 49.6 % Men – 50.4%	Negative – 59.8% Positive – 40.2%	Negative – 21.2% Positive – 57.7% Neutral – 20.7% Undisclosed – 0.4%	Asian – none Black – 0.2% Mixed – 0.8% Other – 0.2% White – 98.8% N/A - none	Full-Time – 53.3% Part-Time – 14.9% Not in paid work[1] – 6.6% Unemployed[2] – 15.1% Other – 9% N/A – 1%
South Africa (n = 383)	Woman – 50.4% Men – 49.6%	Negative – 48.8% Positive – 51.2%	Negative – 20.9% Positive – 65.8% Neutral – 13.1% Undisclosed – 0.3%	Asian – 3.4% Black – 77.5% Mixed – 7.3% Other – 2.1% White – 9.4% N/A – 0.3%	Full-Time – 49.9% Part-Time – 15.4% Not in paid work[1] – 1.3% Unemployed[2] – 23% Other – 8.4% N/A – 2.1%
United States (n = 397)	Woman – 49.9% Men – 50.1%	Negative – 49.9% Positive – 50.1%	Negative – 14.4% Positive – 66% Neutral – 19.1% Undisclosed – 0.5%	Asian – 4.3% Black – 6.5% Mixed – 5% Other – 4% White – 80.1% N/A - none	Full-Time – 44.1% Part-Time – 16.4% Not in paid work[1] – 18.6% Unemployed[2] – 9.1% Other – 6.3% N/A – 5.5%

1 – for example homemaker, retired, disabled, 2 – a job seeking person

In order to explore the characteristics of the participants and test the validity of our

assumptions, we decided to investigate whether attitudes toward vaccines could serve as a group-forming factor and induce in-group favoritism. We considered two indicators of intergroup division: intergroup bias as measured by the *feelings thermometer* and the intensity of online and offline communication with individuals who have similar and opposing attitudes toward the COVID-19 vaccine.

For the *feelings thermometer* we found evidence of strong mutual biases between people with different attitudes toward the vaccine, although biases were stronger among vaccine enthusiasts. We conducted a 2x2x3 within-between-subjects ANOVA with the reference group (ingroup, outgroup) as a within-subjects factor, COVID-19 vaccine attitudes (positive, negative) as a between-subjects factor, and country of residence (Poland, South Africa, USA) as a between-subjects factor. The *feelings thermometer* score (ranging from *0* to *100*) was the dependent variable.

We found the main effect of the group of reference – $F(1, 1255) = 1624.50$, $p < .001$, $\eta_p^2 = 0.56$. The feeling towards the in-group was more positive (on average 38.86 higher on a 0-100 scale). We also found the interaction effect between a group of reference and attitude: $F(1, 1255) = 141.14$, $p < .001$, $\eta_p^2 = 0.1$. The analysis of simple main effects revealed that in-group/out-group difference in the *feeling thermometer* was statistically significant for both vaccine enthusiasts and vaccine skeptics, but greater for vaccine enthusiasts (Mean difference 50.31 vs. 27.4). The interaction between the group of reference, attitude, and country was also significant - $F(2, 1255) = 21.73$, $p < .001$, $\eta_p^2 = 0.03$. The visual analyses revealed that in the case of RPA, the prejudice towards out-groups is similarly strong among vaccine-skeptics and vaccine-enthusiasts while in the case of Poland, the prejudice among vaccine-enthusiasts

surpasses those among vaccine-skeptics the most.

Analogical 2x2x3 between-within subject ANOVAs was conducted for the "online contact intensity" and "offline contact intensity" dependent variables. It turned out that in the case of both types of contacts, participants interacted with members of an out-group more frequently. This effect was stronger in the case of vaccine-enthusiasts.

In the case of online contact, we found a significant main effect of the group of reference - $F(1, 1248) = 189.13$, $p < .001$, $\eta_p^2 = 0.13$. The frequency of online interactions with ingroup contact was on average 10.97 higher. (the scale ranged from *0 - never*, *100 – on daily basis*). We found a significant interaction effect between a group of reference and attitude towards the COVID-19 vaccine - $F(1, 1248) = 28.14$, $p < .001$, $\eta_p^2 = 0.02$. The analysis of simple main effects revealed that the difference in the online contact between in-group and out-group is significant for both vaccine-enthusiasts and vaccine-skeptics, but larger in the case of vaccine-enthusiasts (mean difference 15.2 vs 6.74).

In the case of an offline contact, we identified the same effects. The frequency of contacts was higher for ingroup interactions (on average 14.91 points) - $F(1, 1253) = 266.13$, $p < .001$, $\eta_p^2 = 0.18$. The interaction between the group of reference and attitude was also significant - $F(1, 1248) = 39.81$, $p < .001$, $\eta_p^2 = 0.03$. The main effect (higher intensity of contacts with ingroup) was significant for both vaccine-enthusiasts and vaccine-skeptics but stronger in the case of vaccine-enthusiasts (mean difference – 19.96 vs 8.83).

Besides examining, whether attitudes towards COVID-19 vaccine creates intergroup rifts, we tested to what degree attitudes towards this particular vaccine are associated with general attitudes towards COVID-19 vaccines. It turned out that these two attitudes are highly

convergent – $V = 0.67$, chi^2 (3) = 570.94, $p < .001$.

Animalistic and Mechanistic Dehumanization Between COVID-19 Vaccine-enthusiasts and Vaccine-skeptics

To test the first hypothesis (H1): *Vaccine-enthusiasts will animalistically dehumanize vaccine-skeptics*, we estimated (REML method) a mixed linear regression model with respondent ID and country as a random factor for intercepts and a group of reference (ingroup vs. outgroup) as a fixed factor. The hypotheses were tested with three dependent variables separately: animalistic dehumanization (full *human-uniqueness* index), desirable *human-uniqueness* traits, and undesirable *human-uniqueness* traits. It is worth noticing that evaluating out-group members lower on a full *human-uniqueness* index can be interpreted as evidence for animalistic dehumanization of the out-group. Evaluating the out-group higher on negative *human-uniqueness* and lower on positive *human-uniqueness* traits is evidence for negative bias (prejudice) towards the outgroup.

In the case of the full index and desirable traits, we found evidence for animalistic dehumanization in the predicted direction. In the case of undesirable traits, we found evidence for the opposite effect – these traits were ascribed more to the out-group than the in-group.

Moreover, we found that the *ICC* (intracluster correlation coefficients) for the "Country" variable was very small (ranging from <.000 to .06), indicating that the degree of dehumanization did not vary significantly between the three populations (RPA, USA, and Poland).

See the detailed results in the tables (Table 2 and Table 3) below:

Table 2

Animalistic Dehumanization of Anti-vaccine People by Pro-vaccine people: Linear Mixed Model, Fixed Effects

	Effect	Estimate	SE	95% CI (Lower)	95% CI (Upper)	df	t	p
Animalistic dehumanization (full index)	(Intercept)	39.96	1.24	37.53	42.40	2	32.13	< .001
	outgroup - ingroup	-4.31	0.47	-5.23	-3.40	588	-9.23	< .001
Animalistic dehumanization (desirable traits)	(Intercept)	45.43	0.63	44.20	46.67	588	72.17	< .001
	outgroup - ingroup	-36.38	1.03	-38.4	-34.36	588	-35.34	< .001
Animalistic dehumanization (undesirable traits)	(Intercept)	34.49	2.29	30.00	38.99	2	15.04	0.004
	outgroup - ingroup	27.75	1.04	25.70	29.80	588	26.58	< .001

Table 3

Animalistic Dehumanization of Anti-vaccine People by Pro-vaccine People: Linear Mixed Model, Random Components

	Groups	Name	SD	Variance	ICC
Animalistic dehumanization (full index)	ID	(Intercept)	11.30	127.73	0.67
	Country	(Intercept)	1.96	3.83	0.06
	Residual		8.02	64.28	
Animalistic dehumanization (desirable traits)	ID	(Intercept)	8.80	77.4	0.2
	Country	(Intercept)	0.00	0.0	<0.00
	Residual		17.66	312.0	
Animalistic dehumanization (undesirable traits)	ID	(Intercept)	9.93	98.66	0.24
	Country	(Intercept)	3.80	14.45	0.04
	Residual		17.92	321.06	

Note. Number of Obs: 1178, groups: ID 589, Country 3

Summing up, the hypothesis was partially confirmed. It is worth noticing that the extent of overall animalistic dehumanization is smaller than a sheer positive bias towards ingroup. Members of the outgroup have been evaluated on average 4.31 lower on "human uniqueness" (100-point scale), 35.4 points lower on desirable uniquely human traits, and 27.8 points higher on undesirable uniquely human traits.

To test the second hypothesis (H2): Vaccine skeptics will mechanistically dehumanize vaccine enthusiasts, we estimated (REML method) a linear mixed-model with respondent ID and country as a random factor for intercept and group of reference (in-group vs. out-group) as a fixed factor. Analogically to the first hypothesis, we tested H2 with three separate dependent variables: with general mechanistic dehumanization index (*human-nature* index), with desirable human-nature traits, and with undesirable *human-nature* traits.

The hypothesis was disconfirmed. In the case of general mechanistic dehumanization, we found an effect in the opposite direction: vaccine skeptics tended to ascribe *human-nature* traits more to vaccine enthusiasts than themselves. The same can be said about undesirable *human-nature* traits. Only in the case of desirable *human-nature* traits, the relationship was in the predicted direction – Vaccine skeptics ascribed more of these traits to themselves than to vaccine enthusiasts.

When it comes to the difference between the three populations, we found evidence in favor of the universality – *ICC* for "Country" factor was low, ranging from .02 to .13. See detailed results in the tables (Table 4, Table 5) below.

Table 4

Mechanistic Dehumanization of Pro-vaccine People by Anti-vaccine People: Linear Mixed Model, Fixed Effects

	Effect	Estimate	SE	95% CI (Lower)	95% CI (Upper)	df	t	p
Mechanistic dehumanization (full index)	(Intercept)	40.78	1.23	38.36	43.20	2.08	33.08	< .001
	outgroup - ingroup	2.25	0.45	1.38	3.13	672	5.04	< .001
Mechanistic dehumanization (desirable traits)	(Intercept)	47.80	1.68	44.50	51.11	2.08	28.37	< .001
	outgroup - ingroup	-5.91	1.04	-7.95	-3.86	672	-5.65	< .001
Mechanistic dehumanization (undesirable traits)	(Intercept)	33.59	4.05	25.65	41.54	2.01	8.29	0.014
	outgroup - ingroup	10.41	0.99	8.46	12.35	672	10.50	< .001

Table 5

Mechanistic Dehumanization of Pro-vaccine People by Anti-vaccine People: Linear Mixed Model, Random Components

	Groups	Name	SD	Variance	ICC
Mechanistic dehumanization (full index)	ID	(Intercept)	13.23	174.90	0.72
	Country	(Intercept)	1.90	3.60	0.05
	Residual		8.19	67.08	
Mechanistic dehumanization (desirable traits)	ID	(Intercept)	12.35	152.63	0.29
	Country	(Intercept)	2.64	6.97	0.02
	Residual		19.17	367.30	
Mechanistic dehumanization (undesirable traits)	ID	(Intercept)	11.21	125.63	0.28
	Country	(Intercept)	6.92	47.92	0.13
	Residual		18.18	330.67	

Note. Number of Obs: 1346 , groups: ID 673, Country 3

Summing up, we found no evidence for the mechanistic dehumanization of vaccine enthusiasts by vaccine skeptics, but we found evidence for negative bias. Vaccine skeptics estimated positive aspects of human nature as more prevalent among them (on average 5.91 points higher on a 100-point scale) and negative aspects of human nature as less prevalent (on average 10.41 lower on a 100-point scale).

Post-hoc analyses: mutual animalistic dehumanization in USA, RPA and Poland.

To complement the results obtained in the confirmatory analyses, we decided to explore the patterns of animalistic dehumanization of vaccine enthusiasts by vaccine skeptics and to present a visual analysis of all the patterns for three investigated populations separately.

It turned out that there are no indications of general, animalistic dehumanization of vaccine enthusiasts by vaccine skeptics. On the contrary, in linear mixed model analyses (random factor for intercepts: ID, country, fixed factor: a group of reference), we found that vaccine skeptics estimated the *human-uniqueness* index to be 1.78 points higher (100-point scale) for an outgroup (vaccine enthusiasts) than for themselves - b = 1.78, 95% CI [0.83; 2.73], t (2.03, 678) = 3.67, p <.001.

Despite the lack of evidence for general animalistic dehumanization, we found a pattern suggesting positive bias towards in-group: positive aspects of human nature were ascribed more eagerly to the vaccine-skeptics - b = -11.01, 95% CI [-13.14; -8.89], t(672,672) = -10.16, p <.001), while negative aspects of human nature less eagerly (b = 14.57, 95%CI [12.44; 16.71], t (2.03,672) = 13.39, p <.001.

Overall, the patterns of mutual animalistic dehumanization display four trends:

1) Animalistic dehumanization towards vaccine skeptics by vaccine enthusiasts is

identifiable while being absent or reversed in the attitude of vaccine skeptics towards vaccine enthusiasts,

2) Positive in-group bias (ascribing more positive and less negative traits to the in-group members) is observed among both vaccine enthusiasts and vaccine skeptics, but is stronger in the case of the former,

3) In comparison to vaccine skeptics, vaccine enthusiasts are more eager to attribute uniquely-human traits to themselves and more inclined to view themselves in a favorable way (by attributing many positive uniquely-human traits and few negative uniquely-human traits),

4) Results are largely similar across all three investigated populations.

Figure 2

Animalistic Dehumanization (Attributions of Human-uniqueness Traits) Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.

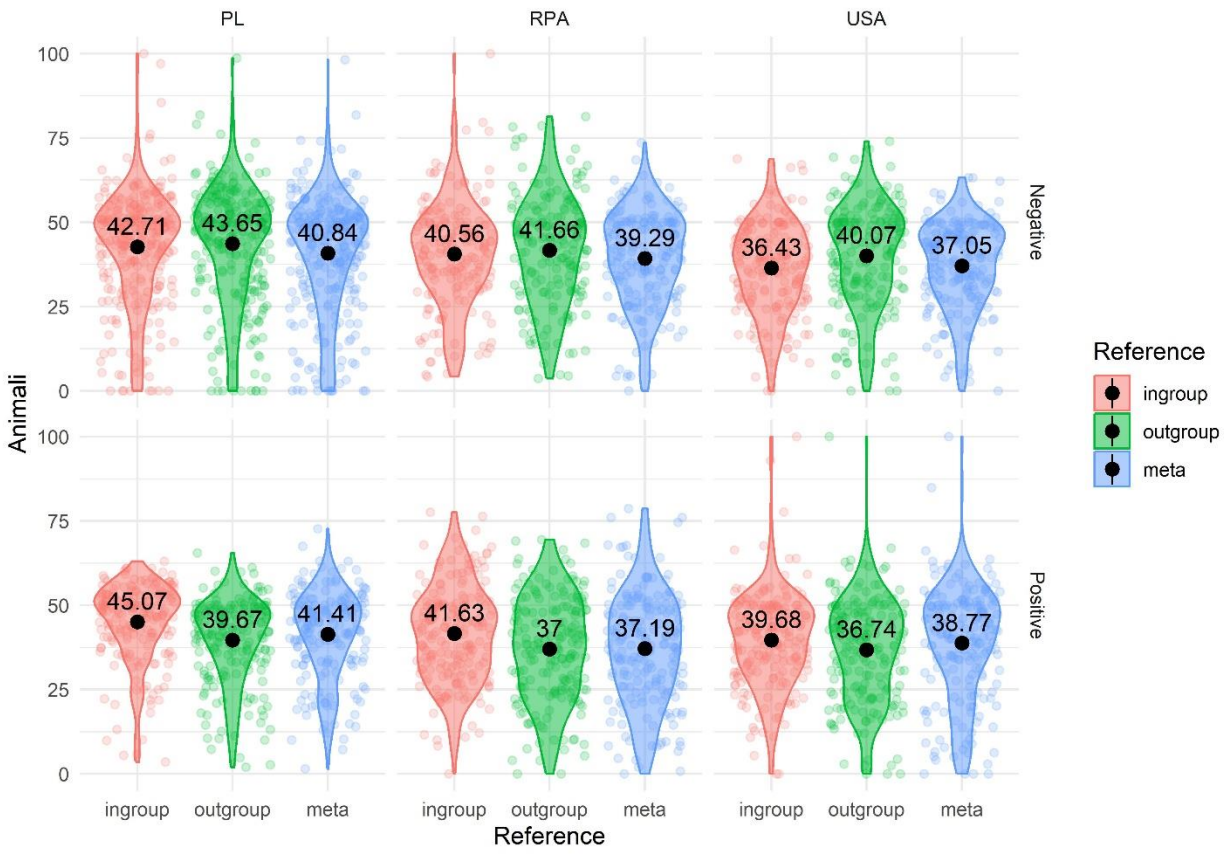


Figure 3

Attributions of Positive Human-uniqueness Traits Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.

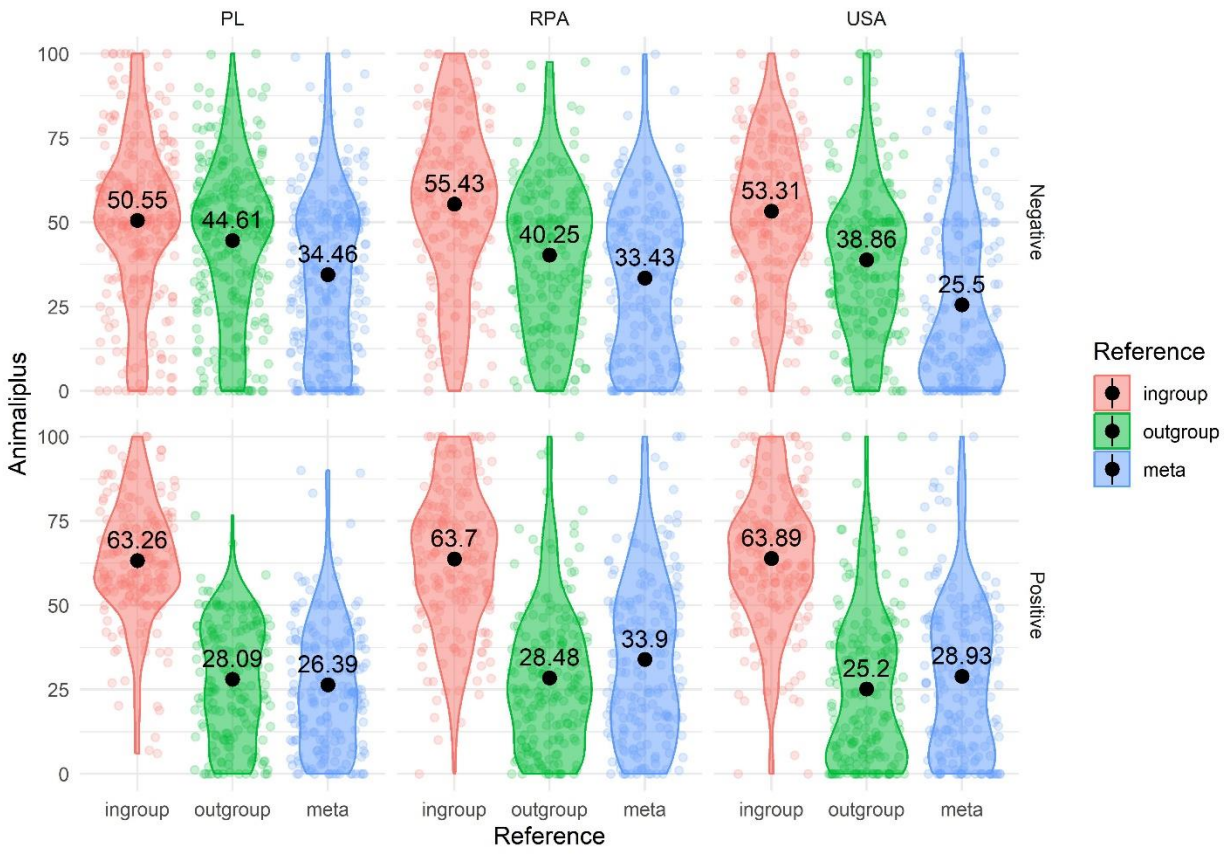
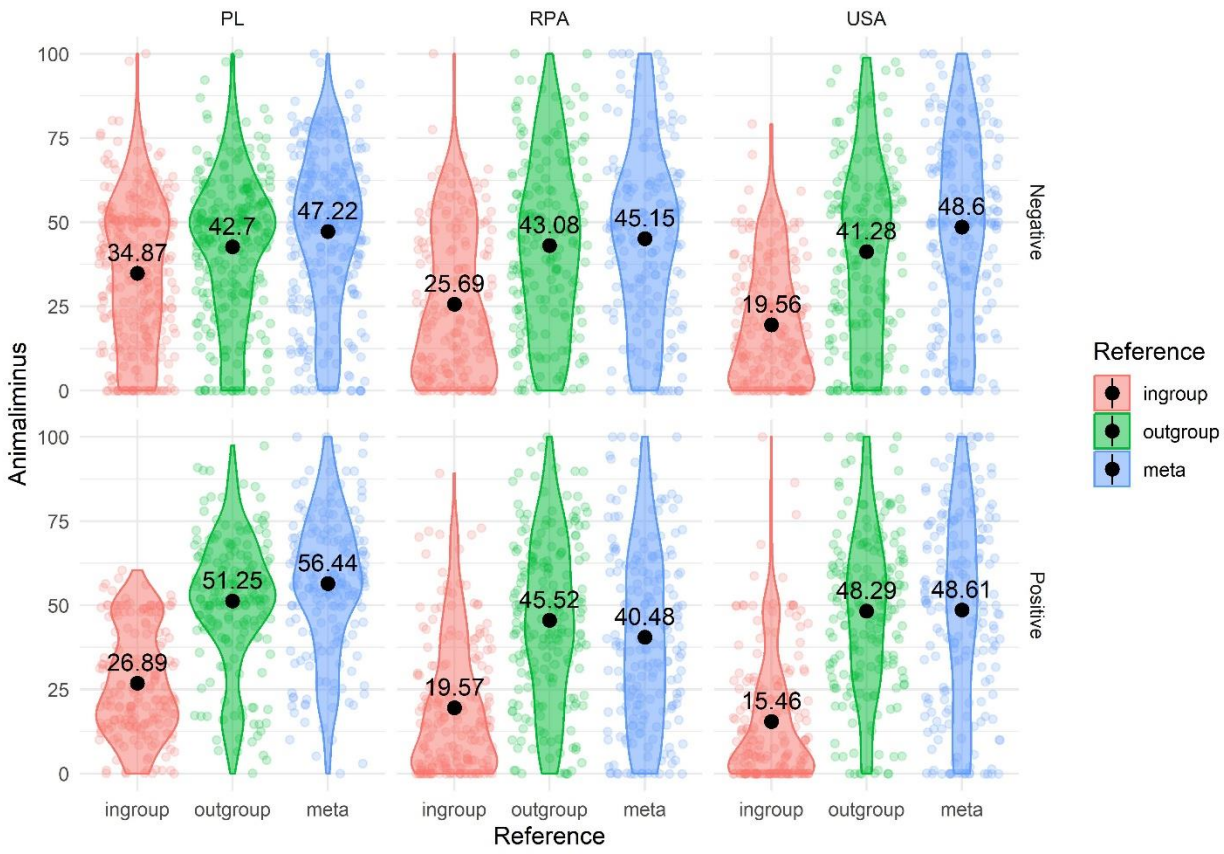


Figure 4

Attributions of Negative Human-uniqueness Traits Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.



Post-hoc analyses: mutual mechanistic dehumanization in USA, RPA and Poland.

Our prediction that vaccine-skeptics will mechanistically dehumanize vaccine-enthusiasts have been disconfirmed, but we decided to test this type of dehumanization in the opposite direction. Linear mixed-model analyses (random factor for intercepts: ID, country, fixed factor: group of reference) suggest that vaccine enthusiasts mechanistically dehumanize vaccine-enthusiasts – Vaccine enthusiasts estimated the average prevalence of human-nature traits to be 6.28 lower among vaccine-skeptics - $b = -6.28$, 95% CI [-7.23; -5.34], $t(588,588) = -12.99$, $p < .001$.

Apart from mechanistic dehumanization, we also found evidence suggesting positive bias towards the in-group. Desirable human-nature traits were estimated to be 40.27 less prevalent among vaccine-skeptics than vaccine-enthusiasts - $b = -40.27$, 95% CI [-42.46; -38.07], $t(2,588) = -35.97$, $p < .001$. Undesirable human-nature traits were estimated to be 27.70 more prevalent among vaccine-skeptics than vaccine-enthusiasts - $b = 27.70$, 95% CI [25.70; 29.70], $t(2,588) = -27.13$, $p < .001$.

Summing up, the processes of mechanistic dehumanization are less symmetrical and less universal but similar to the ones concerning animalistic dehumanization. We can sum up the patterns in four points:

1) While vaccine enthusiasts mechanistically dehumanize vaccine skeptics, there is no evidence for the opposite process,

2) Positive ingroup bias (ascribing more positive and less negative traits to the ingroup members) is observed among both vaccine enthusiasts and vaccine skeptics, but is stronger in the case of the former,

3) In comparison to vaccine-skeptics, vaccine-enthusiasts are more eager to attribute human-nature traits to themselves and more inclined to view themselves in a favorable way (by attributing many positive human-nature traits and few negative human-nature traits),

4) Investigated populations displayed effects of similar direction and general pattern, but the magnitude differed. Patterns of positive in-group bias were the most pronounced in the USA and the least pronounced in Poland.

Figure 5

Mechanistic Dehumanization (Attributions of Human-uniqueness Traits) Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.

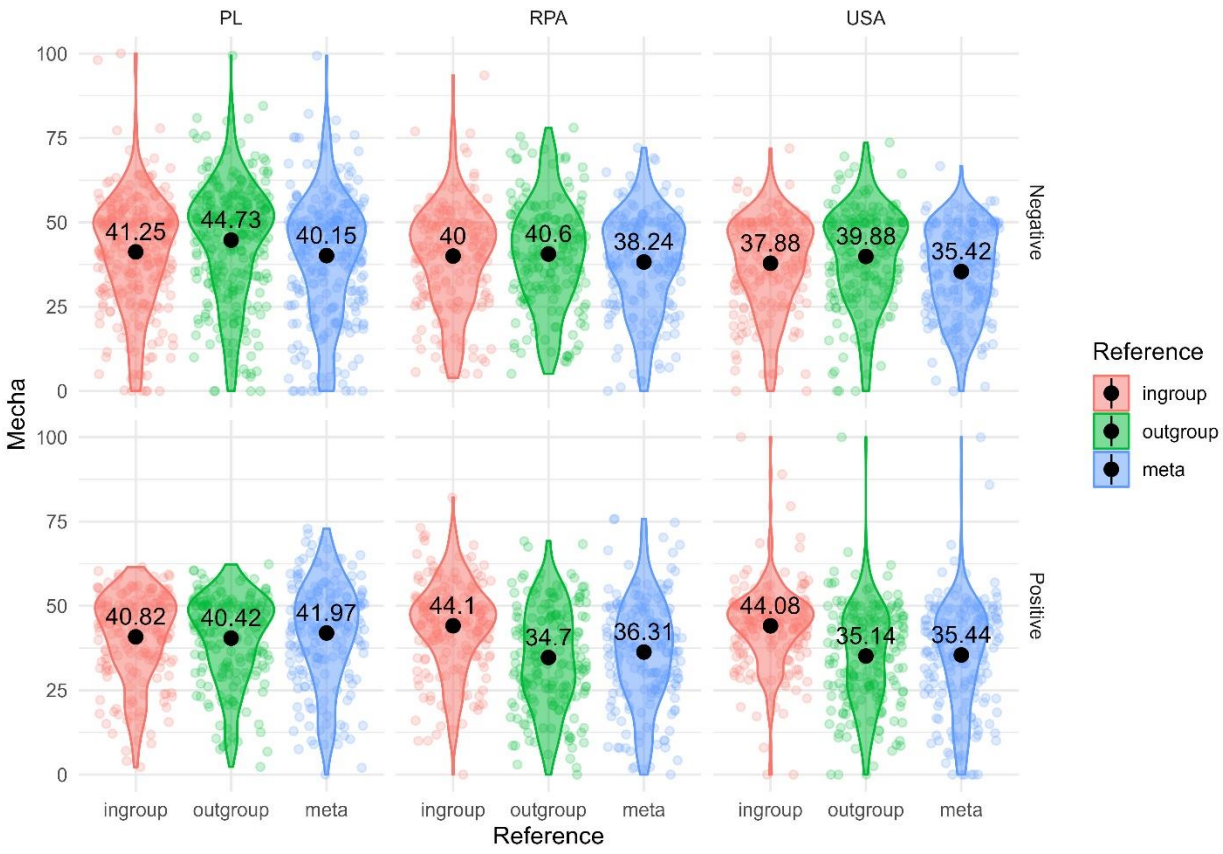


Figure 6

Attributions of Positive Human-nature Traits Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.

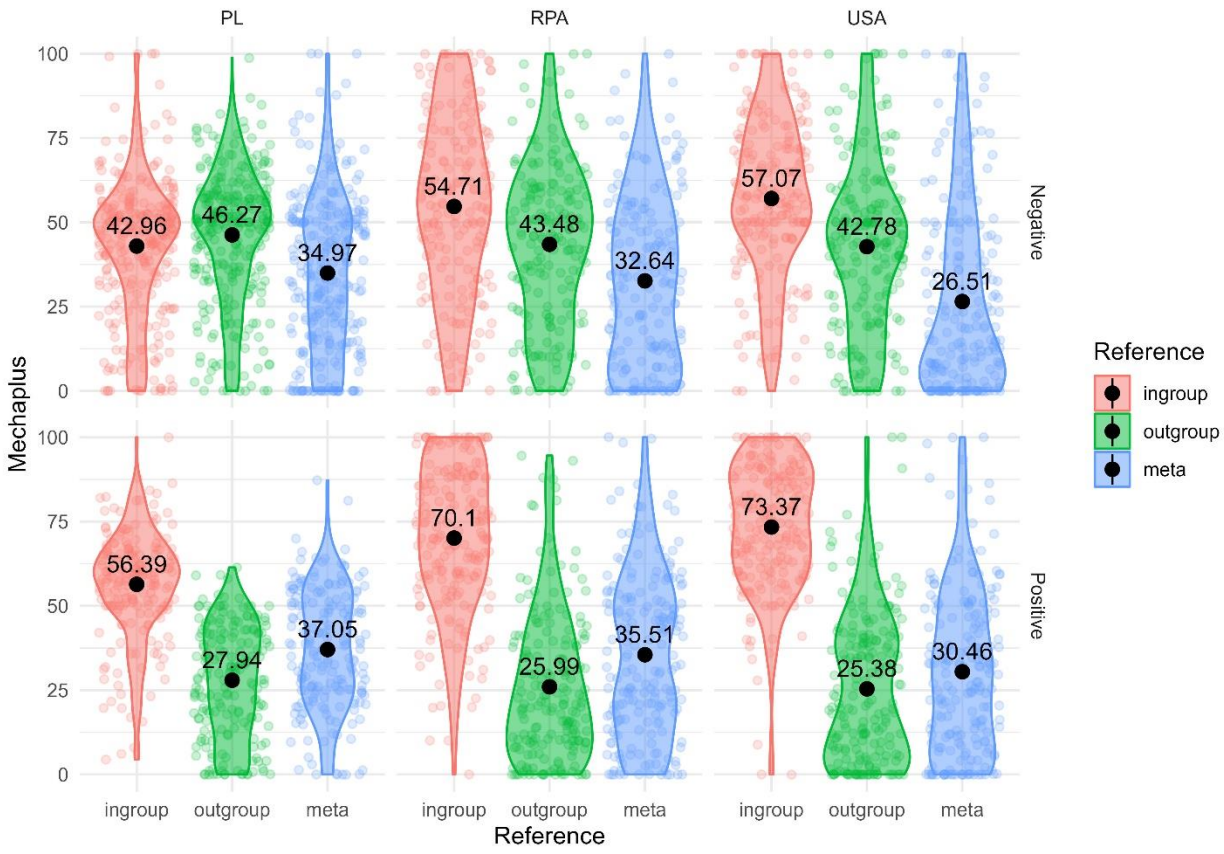
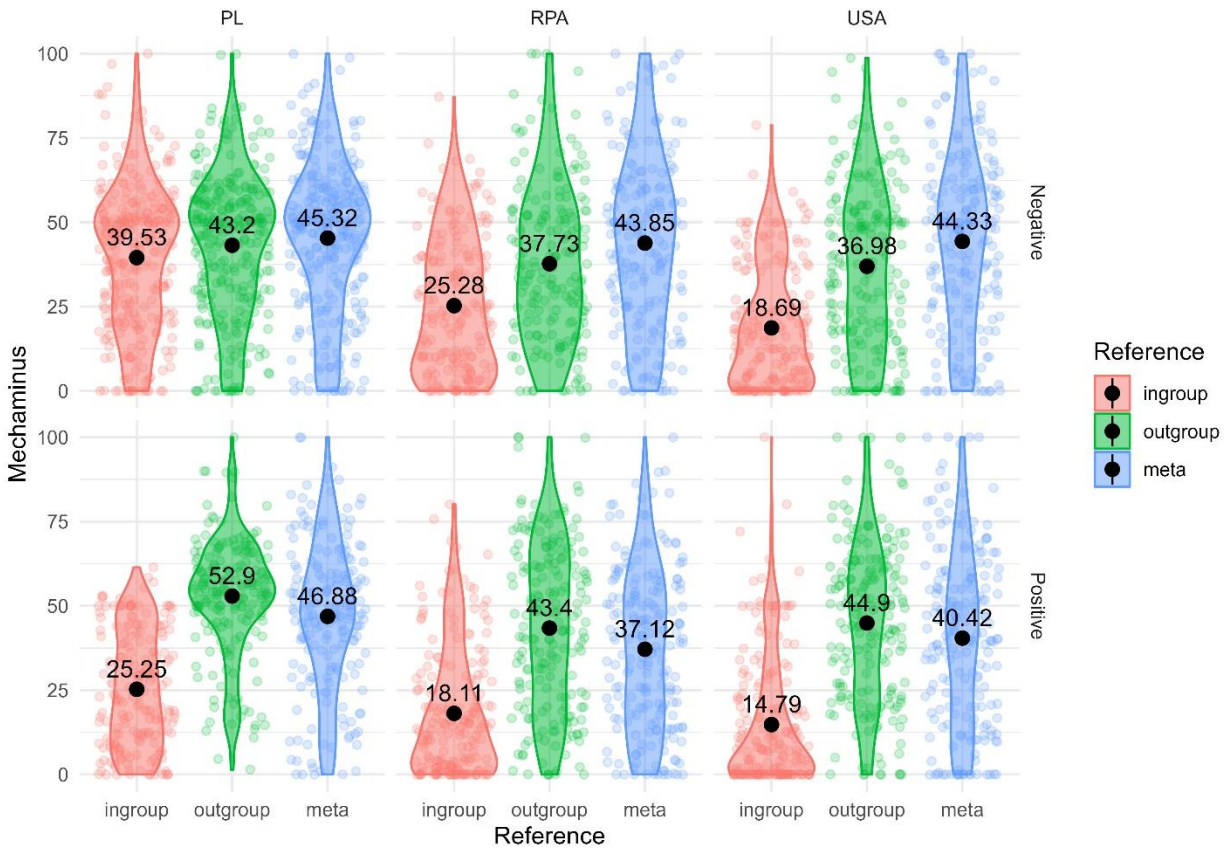


Figure 7

Attributions of Negative Human-nature Traits Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.



Blatant and direct dehumanization between COVID-19 vaccine*-enthusiasts *and vaccine-skeptics

To test the third hypothesis (H3): *Vaccine enthusiasts will blatantly dehumanize vaccine skeptics*, we estimated a logistic regression mixed model with respondent ID and country as a random factor for intercept and group of reference (in-group vs. out-group) as a fixed factor. The dependent variable was a dichotomized *blatant dehumanization* (0: non-full humanity, 1: full humanity).

The hypothesis was confirmed. There was a significant difference between the probability of ascribing full humanness to the members of the in-group (vaccine enthusiasts) and out-group (vaccine skeptics). The probability of ascribing the full humanity to the in-group was 89%, for the out-group it was 20 %: $\chi 2 = 70.64$, $p < .001$. The out-group/in-group odds-ratio (P(1)/P(0)) was *exp(B)* = 0.03, 95% CI [0.01, 0.07], $p < .001$.

Once again, the effects proved to be similar among investigated categories (RPA, USA, Poland): The *ICC* for country < .00.

Post-hoc analyses – Mutual blatant dehumanization in USA, RPA and Poland

Testing the pre-registered hypotheses, we confirmed our prediction that vaccine enthusiasts blatantly dehumanize vaccine skeptics. We decided to explore the opposite direction – the dehumanization of vaccine enthusiasts by vaccine skeptics. Moreover, we present a visual analysis of mutual blatant dehumanization in three investigated populations.

It turned out that vaccine skeptics tend to blatantly dehumanize vaccine enthusiasts. Logistic regression mixed model with respondent ID and country as a random factor for intercept and group of reference (in-group vs. out-group) as a fixed factor revealed a significant

effect of a group of reference on dichotomized *Ascent of Humans* score ($\chi 2 = 61.19$, $p < .001$).

Vaccine skeptics attributed full humanness to 63% of their in-group members and 32% of the out-group members. The out-group/in-group odds-ratio (P(1)/P(0)) was *exp(B)* = 0.28, 95% CI [0.20, 0.38], $p < .001$.

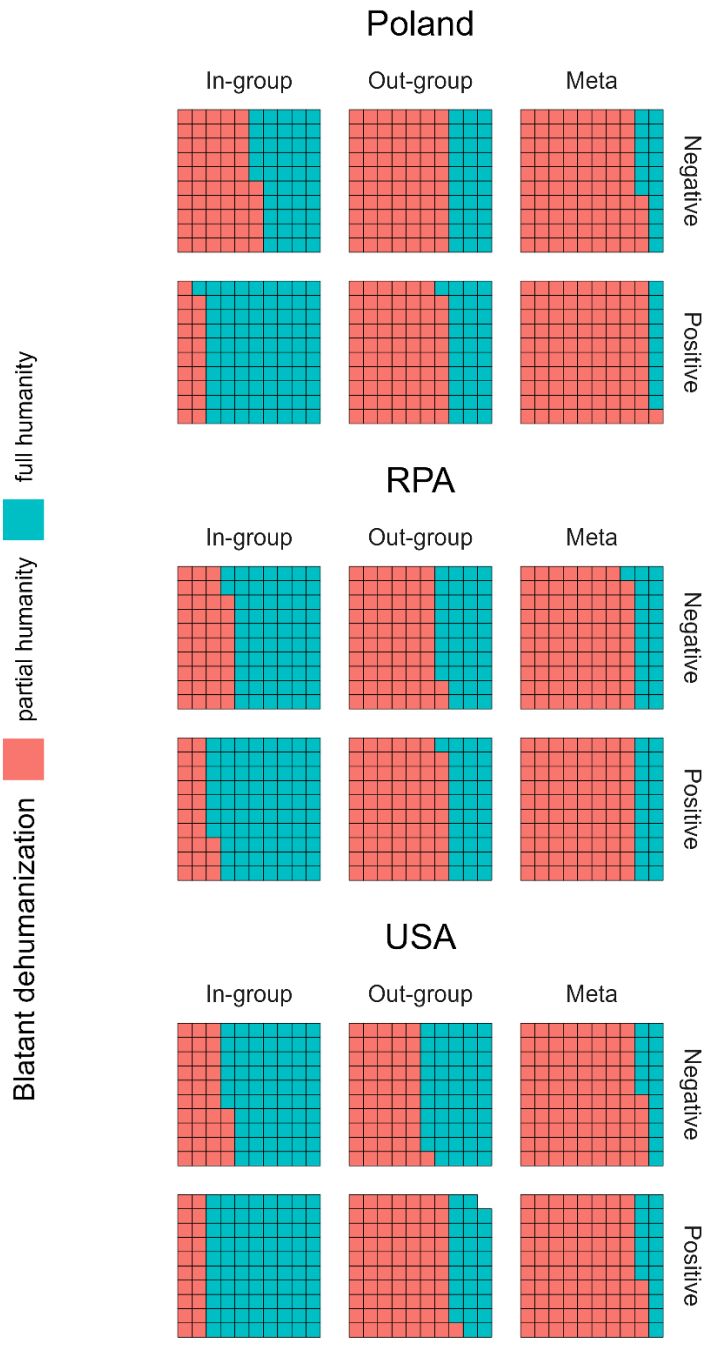
When it comes to mutual blatant dehumanization among all investigated populations, we identified two striking patterns:

1) Blatant dehumanization (difference in the attribution of full humanness between in-group and out-group) is easily identified in all populations among both vaccine-skeptics and vaccine enthusiasts,

2) Vaccine enthusiasts and vaccine skeptics differ in how they attribute humanness to in-group and out-group – Vaccine enthusiasts humanize themselves more (attribute full humanness more often) than vaccine-skeptics. For this reason, the dehumanization of vaccine skeptics by vaccine enthusiasts is stronger than the opposite process.

Figure 8

Dichotomized "Ascent of Humans" Scores Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.



Post-hoc Analyses: Mutual Airect Dehumanization (Animal/human-related Words) in USA, RPA and Poland.

Direct dehumanization (Viki et al., 2006), also known as *human/animal-related words*, is another method of investigating more literal forms of dehumanization. We did not pose any hypotheses related to this measurement. Instead, we conducted an exploratory analysis in order to estimate its prevalence, magnitude, direction, and universality.

Linear mixed model analyses (random factor for intercepts: ID, country, fixed factor: a group of reference) revealed that vaccine-skeptics estimated the animal-related words to be a more fitting description of vaccine enthusiasts than vaccine skeptics. The difference was 8.66 (100-point scale), and it was statistically significant - b = 8.66, 95% CI [6.81; 10.52], t(2.01, 672) = 9.17, p <.001. This effect was less universal than other types of investigated dehumanization – *ICC* for the "Country" cluster equaled 0.2.

We tested the analogical model for human-related words. It turned out that vaccine skeptics estimated these words as more fitting to themselves than to their opposition. The difference was 5.86 (100-point scale), and it was statistically significant - b = -5.86, 95% CI [-7.64; -4.08], t(2.01, 672) = -6.42, p <.001. *ICC* for "Country" cluster equaled 0.25.

Concerning vaccine enthusiasts, linear mixed model analyses (random factor for intercepts: ID, country, fixed factor: a group of reference) revealed that they found animal-related words more adequate description of an out-group (vaccine skeptics) than themselves. The difference was 6.79 (100-point scale), and it was statistically significant - b = 6.79, 95% CI [5.09; 8.50], t(2, 588) = 7.81, p <.001. *ICC* for "Country" cluster equaled 0.08.

When it comes to human-related words, vaccine enthusiasts found them more

adequate as a self-description than the description of vaccine skeptics. The difference was 15.04 (100-point scale), and it was statistically significant - b = -15.04, 95% CI [-17.02; -13.06], $t(2, 588) = - 14.9$, $p < .001$). *ICC* for "Country" cluster equaled 0.04.

Figure 9

Opinions About Adequacy of Animal-related Words as a Description of In-group and Out-group Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.

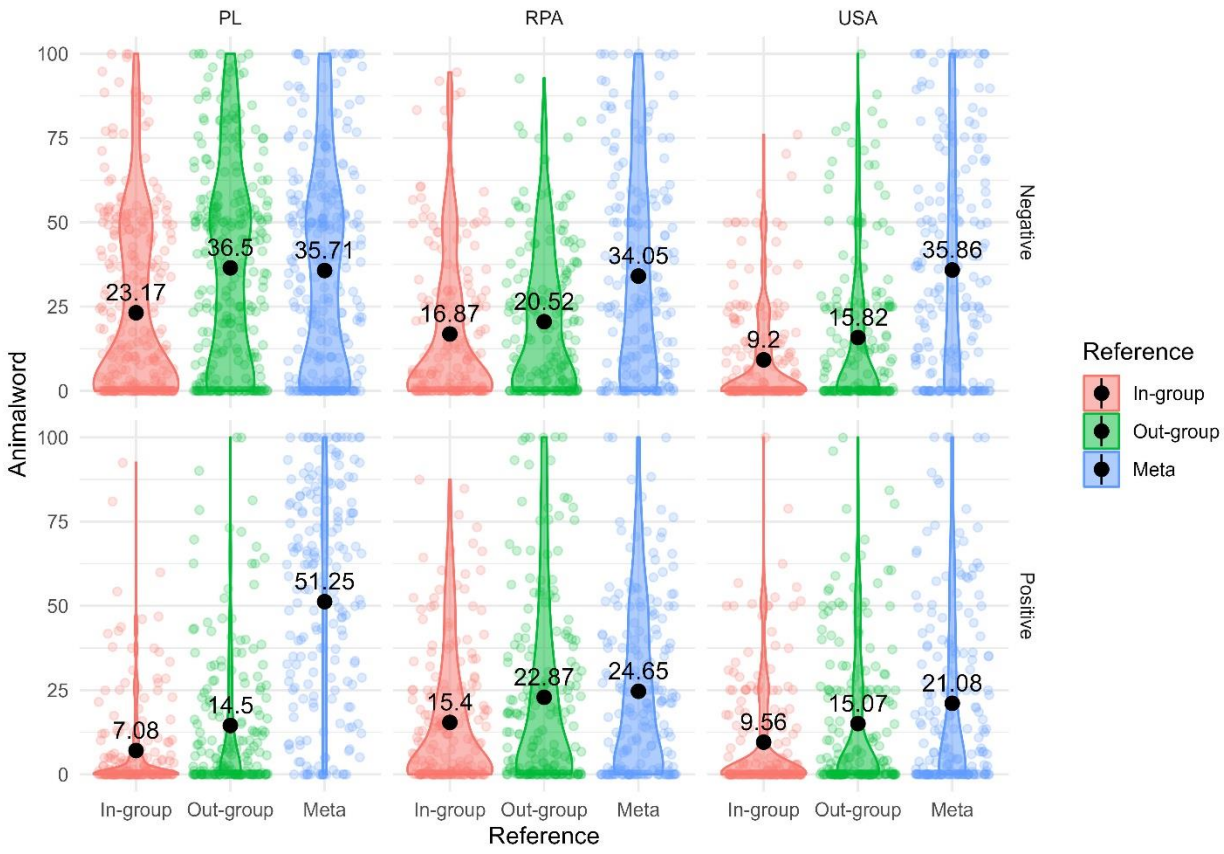
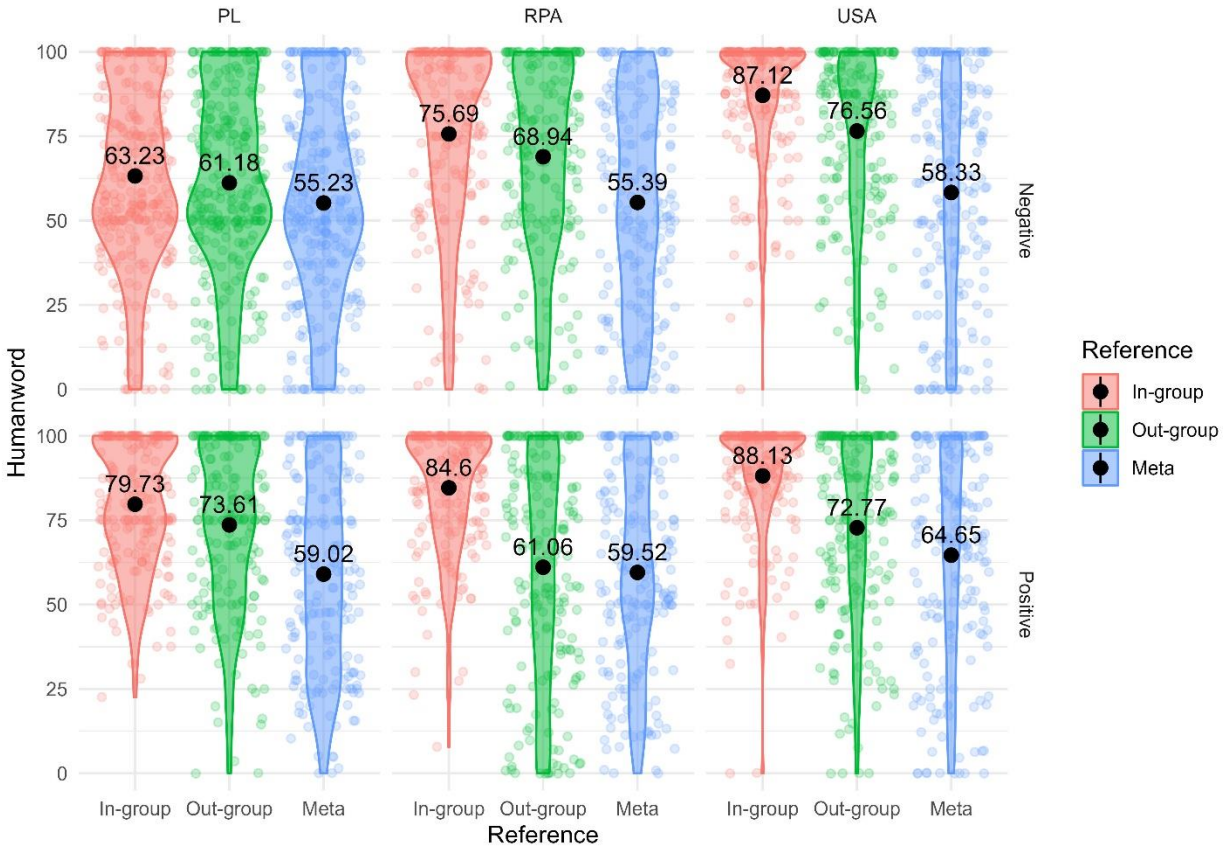


Figure 10

Opinions About Adequacy of Human-related Words as a Description of In-group and Out-group Members Among Vaccine-enthusiasts (Positive) and Vaccine-skeptics (Negative) in Three Countries.



Meta-dehumanization Between COVID-19 Vaccine Enthusiasts and Vaccine Skeptics

To test the fourth hypothesis (H4a): *Vaccine skeptics will experience meta-dehumanization (They will believe, they are blatantly dehumanized by pro-vaccine people.)*, we estimated a logistic regression mixed model with respondent ID and country as a random factor for intercept and group of reference (in-group vs. meta) as a fixed factor. The dependent variable was a dichotomized *blatant dehumanization* (0: non-full humanity, 1: full humanity).

The hypothesis was confirmed. The probability of ascribing full humanity to an ingroup (vaccine skeptics) was 63%, while the estimated probability of ascribing full humanity to them by vaccine enthusiasts was 7%. The difference was statistically significant: $\chi 2 = 99.01$, $p < .001$. The meta/in-group odds-ratio (P(1)/P(0)) was *exp(B)* = 0.05, 95% CI [0.03, 0.09], $p < .001$.

The last prediction (H4b) (*In the relationship predicted in hypothesis H4a, the intensity of online interactions with vaccine enthusiasts will be a significant covariate*) was tested analogously to H4a, with one addition - the intensity of online and offline communication with members of an out-group were added to the model as covariates. We found no evidence for the presence of covariate effects (online interactions - $b < 0.00$, $p = .83$, offline interaction - $b < 0.00$, $p = .46$).

In conclusion, we found evidence of strong meta-dehumanization experienced by vaccine skeptics, but there is no evidence that this effect is related to the level of social interaction between vaccine skeptics and vaccine enthusiasts.

Post-hoc analyses: Patterns of all Types of Meta-dehumanization

Visual analyses revealed that all types of meta-dehumanization were experienced by both vaccine skeptics and vaccine believers. This was true regardless of country. For all

dehumanization types (animalistic, mechanistic, blatant, and direct) and their subtypes, we found that ingroup members predicted outgroup members' less favorable perceptions (see Figures 2-7, 8-9).

We decided to formally test and compare meta-dehumanization as measured by the *Ascent of Humans* scale and *animal/human-related* words (*direct dehumanization*). In the case of the *Ascent of Humans* scale, analysis for H4a revealed that vaccine skeptics experience meta-dehumanization. Post-hoc analyses revealed that vaccine enthusiasts experience this type of meta-dehumanization even more. We tested a logistic regression mixed model (random factor for intercept: ID, country; fixed factor: reference group [in-group vs. meta]; dependent variable: *Ascent of Humans* for the vaccine enthusiasts). It turned out that the probability of attributing full humanity to in-group members (vaccine enthusiasts) was > 0.999. The probability of in-group members believing that out-group members would attribute full humanity to them was < 0.001. The difference was statistically significant - $\chi 2 = 2.80 \times 10^9$, $p < .001$.

In the case of human- and animal-related words, we tested linear regression mixed models with ID and country as random factors for the intercepts, reference group (in-group vs. meta) as a fixed factor, and the respective dehumanization scale as the dependent variable.

It turned out that vaccine skeptics rated themselves as more human than they predicted out-group members to see them. For animal-related words, the difference in ratings was 17.98 (on a 100-point scale) - $b = 17.98$, 95% CI [15.63; 20.34], $t(2.07, 672) = 12.69$, $p = .005$. For human-related words, the difference in ratings was 17.53 - $b = - 17.53$, 95% CI [-19.84; -15.22], $t(2.02, 672) = -14.89$, $p < .001$.

Vaccine enthusiasts experienced an even higher degree of meta-dehumanization. For

animal-related words, the difference in ratings was 21.52 (on a 100-point scale) - b = 21.52, 95% CI [18.94; 24.10], t(2, 588) = 16.32, p <.001. For human-related words, the difference in ratings was 23.10 - b = - 23.10, 95% CI [-25.31; -20.88], t(2, 588) = -20.44, p <.001.

Discussion

We examined a diverse, multicultural, and multi-ethnic sample of COVID-19 vaccine enthusiastic and skeptical individuals. Mutual dehumanization of vaccine skeptics and enthusiasts proved to be strong and universal.

We found ample evidence that vaccine enthusiasts dehumanize vaccine skeptics in all three types of dehumanization studied (*dual-model dehumanization*, *blatant dehumanization*, and *direct dehumanization*). Vaccine skeptics dehumanized vaccine enthusiasts on all scales except one – the *human-nature* subscale of *dual-model* dehumanization. The existence of mutual dehumanization and its magnitude was largely independent of the nationality and country of residence of the participants.

Besides the dehumanization, we investigated mutual prejudice and the echo-chamber effect - the tendency to communicate with members of an in-group and avoid contact with members of an outgroup. In both these domains, we found conclusive evidence of strong, inter-group hostility and avoidance. Both vaccine skeptics and vaccine enthusiasts maintain more online and offline communication with people who shares their views. Both of these group holds significantly warmer feelings towards members of their in-group. Taken together, these results support our assumption that attitudes towards vaccines can be the source of group identity and a driving force for negative, inter-group processes.

We were struck by the lack of a clear, distinct set of views that vaccine skeptics and

enthusiasts hold about one another. We predicted that the denial of *human-uniqueness* would be a specific element of the attitude of vaccine enthusiasts toward vaccine skeptics (H1). It turned out that this particular type of dehumanization was relatively weak and present in the views of both vaccine skeptics and enthusiasts. We also predicted that vaccine skeptics would deny the *human-nature* of vaccine enthusiasts (H2). This prediction has been disproved. On the contrary, this kind of dehumanization appeared to be maintained by vaccine enthusiasts against vaccine skeptics. We also predicted that vaccine enthusiasts would overtly dehumanize vaccine skeptics (H3). This prediction was confirmed, but we also found evidence of the same kind of dehumanization in the opposite direction.

In summary - the specific themes identified in narratives from and about vaccine skeptics and enthusiasts (identified by: Jamison et al., 2020; Rozbroj et al. 2021; Lander & Ragusa, 2019; Rozbroj et al., 2022) did not translate into characteristic forms of dehumanization. Instead, we found that:

1) More extreme and direct forms of mutual dehumanization (*Ascent of humans*, *animal/human-related words*) were much more prevalent than subtle forms (*dual-model dehumanization*),

2) In all but one case (*mechanistic dehumanization*), dehumanization was mutual,

3) In all cases, vaccine enthusiasts humanized themselves more than vaccine skeptics,

4) In all but one case (*animal-related* words), vaccine enthusiasts dehumanized vaccine skeptics more than vaccine skeptics dehumanized vaccine enthusiasts.

We predicted (H4a) that vaccine-skeptics will experience meta-dehumanization (within the *Ascent of Humans* scale), which turned out to be true. However, contrary to our

predictions, this relationship was not moderated by the extent of inter-group contact (H4b). Moreover, we found that experiencing meta-dehumanization is universal – it applies to both vaccine-skeptics and vaccine enthusiasts across all investigated types of dehumanization.

Summing up – in the case of COVID-19 vaccine, the wall of intergroup division between skeptics and enthusiasts is tall and solid and is being built from both sides. The wall seems to be made out of the general hostility and dislike rather than elaborated and specific stereotypes – the sheer amount of out-group derogation/hostility expressed in measures such as "feeling thermometer" (*d* = 1, 95%CI [0.93, 1.07]) , "Ascent of humans" (*d* = 0.6, 95%CI [0.54, 0.66]), "animal-related words" (*d* = - 0.34, 95%CI [- 0.40, -0.28]) and "human-related words" (*d* = 0.42, 95%CI [0.36, 0.47]) surpasses the subtle forms of dehumanization captured by *dual-model dehumanization* scale (*human-uniqueness - d =* 0.09, 95%CI [0.03, 0.14], *human-nature - d = 0.14, 95%CI [0.08, 0.20]*). To put these results in context, the magnitude of the expressed prejudice in "feeling thermometer" and "Ascent of humans" scale was comparable to the extent in which Polish in-group expressed prejudice towards one of the most derogated minority outgroup (Roma) - "feeling-thermometer" - *d* = 1.03, "Ascent of humans" - *d* = 0.53 (Izydorczak et al., 2022, database: https://doi.org/10.17605/OSF.IO/C5K8Q).

This pattern of results sheds light on what may have been one of the reasons limiting the effectiveness of pro-vaccine interventions. There are numerous accounts of ineffective (or even counter-effective) attempts to influence attitudes toward vaccination, despite the use of well-established techniques (for example Sadaf et al., 2013; Dolinski et al., 2022). This should not come as a surprise, given that the target group (vaccine-averse individuals or vaccine-skeptics) may view the pro-vaccine message as a message from a hostile group that disparages

them and essentially tries to pull them over to their side. On the other hand, pro-vaccine people (who are obviously behind pro-vaccine campaigns) may find it difficult to develop a message untainted by their oversimplifications and negative stereotypes about their target group.

References

Archie, A. (2022, July 21). The first U.S. case of polio since 2013 has been detected in New York. *NPR*. https://www.npr.org/2022/07/21/1112802233/polio-case-new-york-live-vaccine

Bam, N. E. (2021). Understanding the Motivations for Covid-19 Vaccine Hesitancy in South Africa: Narrative Literature Review. *Gender and Behaviour*, *19*(3), 18298–18304.

Broniatowski, D. A., Jamison, A. M., Qi, S., AlKulaib, L., Chen, T., Benton, A., Quinn, S. C., & Dredze, M. (2018). Weaponized Health Communication: Twitter Bots and Russian Trolls Amplify the Vaccine Debate. *American Journal of Public Health*, *108*(10), 1378–1384. https://doi.org/10.2105/AJPH.2018.304567

Broniatowski, D. A., Quinn, S. C., Dredze, M., & Jamison, A. M. (2020). Vaccine Communication as Weaponized Identity Politics. *American Journal of Public Health*, *110*(5), 617–618. https://doi.org/10.2105/AJPH.2020.305616

COVID Live—Coronavirus Statistics—Worldometer. (n.d.). Retrieved July 23, 2022, from https://www.worldometers.info/coronavirus/

Doliński, D., Kulesza, W., Rędzio, A. M., Muniak, P., Guzek, M., Silczuk, A., & Gujski, M. (2022). The Effects of Offering Freedom to Comply by Pediatricians and Nurses, Using the But-You-Are-Free (BYAF) Technique, on Vaccination Compliance on 185 Parents of Newborn Babies Conducted in Outpatient Clinics in Poland Between January 2022 and July 2022. *Medical Science Monitor*, *29*. https://doi.org/10.12659/MSM.938743

Enock, F. E., Flavell, J. C., Tipper, S. P., & Over, H. (2021). No convincing evidence outgroups are denied uniquely human characteristics: Distinguishing intergroup preference

from trait-based dehumanization. *Cognition*, *212*, 104682. https://doi.org/10.1016/j.cognition.2021.104682

Freeman, D., Loe, B. S., Chadwick, A., Vaccari, C., Waite, F., Rosebrock, L., Jenner, L., Petit, A., Lewandowsky, S., Vanderslott, S., Innocenti, S., Larkin, M., Giubilini, A., Yu, L.-M., McShane, H., Pollard, A. J., & Lambe, S. (2020). COVID-19 vaccine hesitancy in the UK: The Oxford coronavirus explanations, attitudes, and narratives survey (Oceans) II. *Psychological Medicine*, 1–15. https://doi.org/10.1017/S0033291720005188

Haslam, N. (2006). Dehumanization: An Integrative Review. *Personality and Social Psychology Review*, *10*(3), 252–264. https://doi.org/10.1207/s15327957pspr1003_4

Haslam, N. (2015). Dehumanization and intergroup relations. In *APA handbook of personality and social psychology, Volume 2: Group processes* (pp. 295–314). American Psychological Association. https://doi.org/10.1037/14342-011

Hornsey, M. J., & Fielding, K. S. (2017). Attitude roots and Jiu Jitsu persuasion: Understanding and overcoming the motivated rejection of science. *American Psychologist*, *72*(5), 459–473. https://doi.org/10.1037/a0040437

Hornsey, M. J., Finlayson, M., Chatwood, G., & Begeny, C. T. (2020). Donald Trump and vaccination: The effect of political identity, conspiracist ideation and presidential tweets on vaccine hesitancy. *Journal of Experimental Social Psychology*, *88*, 103947. https://doi.org/10.1016/j.jesp.2019.103947

Izydorczak, K., Grzyb, T., & Dolinski, D. (2022). Ascent of Humans: Investigating Methodological and Ethical Concerns About the Measurement. *Collabra: Psychology*, *8*(1), 33297. https://doi.org/10.1525/collabra.33297

Jamison, A. M., Broniatowski, D. A., Dredze, M., Wood-Doughty, Z., Khan, D., & Quinn, S. C. (2020). Vaccine-related advertising in the Facebook Ad Archive. *Vaccine*, *38*(3), 512–520. https://doi.org/10.1016/j.vaccine.2019.10.066

Kteily, N., Bruneau, E., Waytz, A., & Cotterill, S. (2015). The ascent of man: Theoretical and empirical evidence for blatant dehumanization. *Journal of Personality and Social Psychology*, *109*(5), 901–931. pdh. https://doi.org/10.1037/pspp0000048

Kteily, N. S., & Landry, A. P. (2022). Dehumanization: Trends, insights, and challenges. *Trends in Cognitive Sciences*, *26*(3), 222–240. https://doi.org/10.1016/j.tics.2021.12.003

Lander, D., & Ragusa, A. T. (2021). 'A rational solution to a different problem'; understanding the verisimilitude of anti-vaccination communication. *Communication Research and Practice*, *7*(1), 89–105. https://doi.org/10.1080/22041451.2020.1816022

MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161–4164. https://doi.org/10.1016/j.vaccine.2015.04.036

Maciuszek, J., Polak, M., Stasiuk, K., & Doliński, D. (2021). Active pro-vaccine and anti-vaccine groups: Their group identities and attitudes toward science. *PLOS ONE*, *16*(12), e0261648. https://doi.org/10.1371/journal.pone.0261648

Mathieu, E., Ritchie, H., Ortiz-Ospina, E., Roser, M., Hasell, J., Appel, C., Giattino, C., & Rodés-Guirao, L. (2021). A global database of COVID-19 vaccinations. *Nature Human Behaviour*, *5*(7), 947–953. https://doi.org/10.1038/s41562-021-01122-8

Mønsted, B., & Lehmann, S. (2022). Characterizing polarization in online vaccine discourse—A large-scale study. *PLOS ONE*, *17*(2), e0263746. https://doi.org/10.1371/journal.pone.0263746

Reported cases of measles. (2022, July 23). Our World in Data. https://ourworldindata.org/grapher/reported-cases-of-measles

Rozbroj, T., Lyons, A., & Lucke, J. (2019). The mad leading the blind: Perceptions of the vaccine-refusal movement among Australians who support vaccination. *Vaccine*, *37*(40), 5986–5993. https://doi.org/10.1016/j.vaccine.2019.08.023

Rozbroj, T., Lyons, A., & Lucke, J. (2022). Understanding how the Australian vaccine-refusal movement perceives itself. *Health & Social Care in the Community*, *30*(2), 695–705. https://doi.org/10.1111/hsc.13182

Sadaf, A., Richards, J. L., Glanz, J., Salmon, D. A., & Omer, S. B. (2013). A systematic review of interventions for reducing parental vaccine refusal and vaccine hesitancy. *Vaccine*, *31*(40), 4293–4304. https://doi.org/10.1016/j.vaccine.2013.07.013

Stroope, S., Kroeger, R. A., Williams, C. E., & Baker, J. O. (2021). Sociodemographic correlates of vaccine hesitancy in the United States and the mediating role of beliefs about governmental conspiracies. *Social Science Quarterly*, *102*(6), 2472–2481. https://doi.org/10.1111/ssqu.13081

Ten health issues WHO will tackle this year. (n.d.). Retrieved August 1, 2022, from https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019

UNICEF and WHO warn of perfect storm of conditions for measles outbreaks, affecting children. (n.d.). Retrieved July 23, 2022, from https://www.who.int/news/item/27-04-2022-unicef-and-who-warn-of--perfect-storm--of-conditions-for-measles-outbreaks--affecting-children

Viki, G. T., Winchester, L., Titshall, L., Chisango, T., Pina, A., & Russell, R. (2006). Beyond

Secondary Emotions: The Infrahumanization of Outgroups Using Human–Related and Animal–Related Words. *Social Cognition*, *24*(6), 753–775. https://doi.org/10.1521/soco.2006.24.6.753

Walter, D., Ophir, Y., & Jamieson, K. H. (2020). Russian Twitter Accounts and the Partisan Polarization of Vaccine Discourse, 2015–2017. *American Journal of Public Health*, *110*(5), 718–724. https://doi.org/10.2105/AJPH.2019.305564

Wiley, K. E., Leask, J., Attwell, K., Helps, C., Barclay, L., Ward, P. R., & Carter, S. M. (2021). Stigmatized for standing up for my child: A qualitative study of non-vaccinating parents in Australia. *SSM - Population Health*, *16*, 100926. https://doi.org/10.1016/j.ssmph.2021.100926

World Economic Outlook (October 2022). (n.d.). Retrieved October 28, 2022, from https://www.imf.org/external/datamapper/NGDPDPC@WEO

Wynne, B. (1991). Knowledges in Context. *Science, Technology, & Human Values*, *16*(1), 111–121. https://doi.org/10.1177/016224399101600108

Wynne, B. (1992). Misunderstood misunderstanding: Social identities and public uptake of science. *Public Understanding of Science*, *1*(3), 281–304. https://doi.org/10.1088/0963-6625/1/3/004

Żuk, P., Żuk, P., & Lisiewicz-Jakubaszko, J. (2019). The anti-vaccine movement in Poland: The socio-cultural conditions of the opposition to vaccination and threats to public health. *Vaccine*, *37*(11), 1491–1494. https://doi.org/10.1016/j.vaccine.2019.01.073