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Zero-sum mindset and its discontents

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RebuildingMacroeconomics

Zero-Sum Mindset & Its Discontents[1]

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Abstract

Across a wide range of pressing global challenges ranging from political polarization, pandemics, prejudice, and climate change, to trade wars, and economic development, there is an underlying psychological feature that presents a barrier to progress: zero-sum thinking. Perceiving the relationship between individuals, groups, economies and social issues as zero-sum hinders the cooperation that has been a cornerstone to our species' success. Yet surprisingly scant research has examined the psychological processes that underpin zero-sum thinking across domains and situations. This research investigates how a zero-sum mindset, that is, a generalised view of life as a zero-sum game, can shape perceptions, motivations, and behaviours that diminish resources and increase hostility, thereby reinforcing a zero-sum game experience of the world. We present evidence from 9 studies with 3,297 unique participants in the United Kingdom and in the United States using correlational, prospective, and experimental research methods. Our results suggest that a zero-sum view of the world thwarts a society's ability to flourish by undermining trust and cooperation, with serious consequences for the foundations upon which our well-being and our society is built.

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Cooperation and Implicit Game Theory

Coordination and cooperation are fundamental to the success of humans as a species. How we accomplish these aspects of our social life is a subject of reflection and consideration present in some of oldest written records, and it would be no surprise if modern humans speculated on this long before. There are many reasons to believe that the evolution of our intelligence lay in such social practices (Byrne & Whiten, 1976; Goody, 1992; Tomasello, 2019), and their exercise leads to benefits both individually and collectively.

Precise analysis of at least some aspects of this capacity for coordination and strategic behaviour in our interactions with others became possible with von Neuman's seminal paper, "On the Theory of Games of Strategy" (1928). Since then, game theory has made invaluable contributions to our understanding of choices and their consequences in dynamic interactions across fields as diverse as economics, computer science, biology, political science, and philosophy (Axelrod & Dion, 1988; Maynard Smith, 1982; Nash, 1950). These models have enabled game theorists to provide powerful advice to decision makers seeking to choose the best possible strategies. While we are not all game theorists, in a sense we are all lay game theorists. We make implicit assumptions about what kind of game life is and devise strategies for success. These assumptions dramatically shape what we perceive, think, feel and do as we navigate the many challenges we face.

One of the most basic distinctions we make about how a game works is whether or not it is zero-sum. In a zero-sum game, resources and rewards are fixed. Therefore, gains for one party necessarily entail losses for another as all winnings and losses sum to zero (von Neuman & Morgenstern, 1953). In such games, win-win outcomes are impossible, and the interests of different players are diametrically opposed. In contrast, in a non-zero-sum game, resources and rewards can grow, and cooperation can produce positive-sum outcomes where both sides gain. Therefore, this essential distinction about the nature of the game will lead to diverging interpretations of one's relationship with other players, the meaning of success (whether or not it can be shared), and which strategies will be most effective to such ends.

While game theory can model the ideal strategies of many different kinds of games, it provides little insight into the social and psychological architecture which underpin an individual or group's interpretation of what kind of game they believe they are playing; More specifically, whether they will treat their economic and personal relations with others as either zero-sum or non-zero-sum and the social and economic consequences of this implicit determination. If we are seeking to model the choices which actors ultimately make, understanding the architecture of zero-sum thinking will be fundamental for our model building.

The term "zero-sum thinking" describes patterns of reasoning consistent with an appraisal of a situation or domain as zero-sum. If picking the best strategy depends on an accurate appraisal of the game at hand, then zero-sum thinking should be deployed in a zero-sum situation. However, *purely* zero-sum situations are rare in the real world, and tend to exist only when the situation is narrowly conceived. For example, even a tennis match, a prototypical zero-sum game, when considered in a real-world context may be connected to non-zero-sum outcomes for all involved. The benefits of exercise in the sport or perhaps the experience or lessons learned from the

match can be enjoyed by both players—win or lose. Despite this, misappraisals of a situation or domain as zero-sum even when it is objectively and explicitly not zero-sum are far from rare (Meegan, 2010). These misappraisals bear critical implications because the strategies that are appropriate in a real zero-sum situation (e.g., aggression instead of cooperation) can be detrimental in a non-zero-sum situation—leading to worse social and economic outcomes for all concerned.

In particular, zero-sum thinking can antagonize group relationships. Those who view the job market as a zero-sum competition between immigrants and native-born citizens are more likely to oppose help for immigrants and immigration (Esses, Jackson, & Armstrong, 1998). White people are more likely than black people to view racial status as zero-sum, and these zero-sum beliefs predict support for pro-white policies and opposition to policies that aim to help minority groups achieve higher status (Norton & Sommers, 2011; Wilkins, Wellman, Babbitt, Toosi, & Schad, 2015). Men who see gender status as zero-sum are more likely to oppose gender-fair workplace policies (Kuchynka, Bosson, Vandello, & Puryear, 2018). In the context of U.S. political divides, Davidai & Ongis (2019) find that liberals and conservatives differ in the issues they perceive as zero-sum, and that these differences are politically motivated.

Though most of the small body of research on zero-sum beliefs has focused on the role of *domain-specific* beliefs (e.g. seeing the job market as zero-sum), research in cultural psychology has proposed that a *generalized* belief that life is a zero-sum game should be considered a social axiom (Różycka-Tran, Boski, & Wojciszke, 2015). A social axiom refers to the fundamental "generalized beliefs" that differentiate cultures (Leung et al., 2002). In a 37-nation study, Różycka-Tran and colleagues (2015) found that general and economically oriented zero-sum beliefs were associated with worse outcomes on measures of GDP, civil liberty, pluralism, government functioning, and human development at the country-level. At the individual level, zero-sum beliefs were associated with lower satisfaction with life, lower positive emotion and higher negative affect (Różycka-Tran et al., 2019). This evidence raises the intriguing prospect that a truly generalized zero-sum view of the world, that is, without respect to any particular domain, could be even more consequential.

As Różycka-Tran and colleagues suggest, it would be surprising if our social and economic environments did not shape the degree to which we see the world as zero-sum. However, it is also possible that the causality flows in the other direction as well. Research has yet to investigate the mechanisms by which generalized zero-sum thinking may also *give rise* to these negative social and economic outcomes.

When implicit beliefs operate across contexts, they can lead to recursive processes, affecting perception, motivation and behavior across situations and domains—ultimately shaping the reality that one inhabits and reinforcing the belief. In a zero-sum mindset, social and economic relationships are characterized by implicit assumptions of fixed scarcity and antagonism. The overarching hypothesis of this investigation is that the implicit assumption that life is like a zero-sum game can shape perception and behavior in ways that undermine cooperation, diminish growth, and exacerbate hostility, thereby helping to create the very scarcity and antagonism the mindset expected to find.

We examined this hypothesis and its underlying mechanisms across 9 studies with 3,297 participants in the United Kingdom and the United States. To do this, we first adapted the BZSG scale developed by Różycka-Tran and colleagues in order to address the specific aims of this research. Next, in Study 1a we investigated how zero-sum mindset might shape basic social perceptions and cognitive processing across situations and domains. We investigated how zero-sum mindset undermines cooperation through a preoccupation with dominance (Study 1b), and the political (Studies 2-3) and economic (Studies 4-5) consequences that result. Finally, we investigated (Studies 6-9) the central role of trust in facilitating cooperation and growth using and longitudinal and experimental methodologies with both self-report and behavioral measures to tease apart the processes by which a zero-sum mindset can erode trust and cooperation across contexts.

Adapting the BZSG to Measure Zero-Sum Mindset

Różycka-Tran, Boski, & Wojciszke (2015) first developed a measure of "Belief in Life as a Zero-Sum Game" (BZSG), which they employed in a 37-nation study that demonstrated how this belief can function as a "social axiom." The authors describe the BZSG as a measurement of the conviction that "success, especially economic success, is possible only at the expense of other people's failures." Accordingly, 3 out of 8 of the BZSG scale items pertain specifically to the economic domain (see original and modified items in the Appendix).

However, since our investigation is primarily interested in how a generalized view of the world as zero-sum (that is without reference to any particular domain) we predicted that the economically oriented items might represent a manifestation of zero-sum thinking that is closely related to, but distinct from, the generalized zero-sum belief items. In a sample of 821 participants, we found a large difference between the mean-levels of agreement on these generalized zero-sum belief items and the economically worded items such that economic domain zero-sum beliefs were significantly larger than generalized zero-sum beliefs in a paired samples t-test (t = 23.8, p < .0001, Cohen's d = .83). Furthermore, confirmatory factor analysis (pre-registered) demonstrated that the two- factor model separating economically worded items and general zero-sum mindset items into separate dimensions achieved a significantly better model fit than the single factor model ($\Delta\chi2$ = 850.44, p < .0001), with the two-dimensional model achieving acceptable model fit indices ($\chi2$ = 87.63, p < .0001, Comparative Fit Index (CFI) = 0.983, Root Mean Square Error of Approximation (RMSEA) = 0.066) and the single dimension model showing poor model fit ($\chi2$ = 938.067, p < .0001, CFI = 0.775, RMSEA = 0.236) following the criterion suggested by Hu and Bentler (1999).

This leads us to propose that the 8-item BZSG may be described as a two-factor measure of 1) economic zero-sum beliefs (items 2,6 and 8 from the original BZSG) and 2) generalized zero-sum beliefs (items 1,3,4,5 and 7 from the original BZSG), the latter of which we employ as our measure of zero-sum mindset along with the later addition of two "reverse-key" worded items to help balance the scale for acquiescent response style (see the Appendix for more details).

How a Zero-Sum Mindset Shapes Cognitive Processing

It has long been recognised in both modern psychology and a number of traditions which preceded it that experience configures the perceptual and cognitive capacities that we bring to each new moment in our lives. Nowadays these processes are often conceived as a sort of Bayesian inference, where gaps in the focus of interest are filled with that which we perceive to be most likely (Clark, 2013). In the same way, a zero-sum mindset may function like a prior, biasing perception and behaviour towards a zero-sum conclusion, often outside of our own awareness. One particularly striking illustration of this principle in the visual domain is the phenomenon that captured global attention in 2015, now known simply as "the dress." The dress in question was seen by some people as white and gold, and by others as black and blue. This difference of perception lead to some heated exchanges as people found it hard to conceive that anyone could see it differently. Subsequent investigation revealed that *implicit subconscious assumptions* about the lighting – was it in the shade or direct light - determined what colours were perceived (Wallisch, 2017), and that these were mostly a function of whether individuals spent more of their time in daylight or artificial light.

In the same way, one's implicit assumptions about the nature of the context can shape basic perceptions and cognitive processing in ways that are invisible to us. Study 1a investigates how zero-sum mindset can shape perceptions and cognitive style using both implicit and explicit measures.

Study 1a

Hypotheses

In a zero-sum game, an agent's rewards are directly proportional to the losses of another. Therefore, in a zero-sum world it would be reasonable to assume that the intention of other rational self-interested beings will be hostile, rather than benign. Following this logic, we hypothesized that those with a stronger zero-sum mindset would demonstrate heightened perception of hostility, also known as hostile attribution bias.

Furthermore, heightened perception of hostility may be attended by other cognitive corollaries. Research has shown that the perception of threat leads to diminished cognitive resources and preference for simple, rigid, "black and white" thinking that can help one feel safer, and more in control in a threatening environment (Czernatowicz-Kukuczka, Jaśko, & Kossowska, 2014; Jost et al., 2007).

A zero-sum mindset may promote this simpler, more rigid cognitive style in several ways. According to Webster & Kruglanksi (1997), the motivation to seek cognitive closure is "…assumed to be proportionate to the perceived costs or benefits of possessing closure." Chronically heightened perception of threat promoted by a zero-sum mindset may reduce cognitive resources, which would increase the perceived cost of expending cognitive resources needed to process additional information or perspectives (Fox, Russo, & Georgiou, 2005). Perception of threat may also increase the motivation for decisiveness in case there is a need for quick defensive or aggressive action and may increase the motivation for the sense of safety engendered by predictability and low ambiguity (De Zavala, Cislak, & Wesolowska, 2010; Kruglanski et al., 2012).

The effects of these intrapersonal personal factors will be compounded by the operation of interpersonal processes. If one perceives others to have hostile intentions, then one may reasonably be skeptical and avoidant of information provided by them and tend towards an over reliance on one's own pre-existing perspective. Moreover, if one sees a situation as zero-sum then there would be no perceived benefit in the coordination function of perspective-taking, such as when perspective-taking can help one find opportunities for win-win situations in negotiations or in collaborations (Galinsky, Maddux, Gilin, & White, 2008). In fact, if the relationship is perceived to be zero-sum, then one might be *motivated to avoid empathizing* with the other party as this may be perceived to interfere with one's own goals (Zaki, 2014).

Therefore, we hypothesized that zero-sum mindset would predict stronger need for cognitive closure, a measure of cognitive motivation to seek and protect unambiguous decisions or answers on any given topic (Kruglanski & Webster, 2018).

Method

Participants and Procedure. Eight hundred and twenty-one U.S. residents completed the study (70% White, 13% Black/African American, 5% Asian/South Asian, 6% Latin/Hispanic, and 6% Other; 52% female; Ages ranged 18-72, Mage 34.54, SD = 10.66). Participants were recruited using Amazon Mechanical Turk (MTurk). The questionnaire was administered online and took about 11 minutes to complete. Participants who completed the survey received a code they could redeem for a $2.00 reward on MTurk.

Measures.

Zero-Sum Mindset. Zero-sum mindset was measured using the 5 items selected and adapted from the BZSG scale. The scale uses Likert-style response items on a scale from 1 (strongly disagree) to 7 (strongly agree) (Cronbach's α = .90). See Appendix for more details.

Hostile Attribution Bias. Hostile attribution bias was measured using the Word Sentence Association Paradigm - Hostility (WSAP-H) (Dillon, Allan, Cougle, & Fincham, 2016). Conventional measures of hostile attribution bias present participants with short vignettes about ambiguous situations and offer several possible benign and hostile interpretations (Crick & Dodge, 1996). The WSAP-H offers a more implicit measure of hostile attribution bias, using a higher number of responses to a wider number of very briefly presented scenarios. Participants are presented with short sentences, one on screen at a time, which succinctly describe an ambiguous situation that could be interpreted as either hostile or benign (e.g., "Someone bumps into you"). After a one second delay, a single word appears below the sentence suggesting an interpretation. Participants are instructed to quickly rate the word and sentence to be either "related" or "unrelated," scored as either 1 or 0 respectively. Each sentence is presented twice, once with a hostile attribution word and once with a benign attribution word (e.g., "accidental" or "aggressive"). Thirty sentences were selected from the full WSAP-H paradigm, each presented with a benign and hostile attribution word for a total of 60 items. The sentences were also adapted to include a random, balanced distribution of the sentence subject (either

"someone" or "a stranger") producing a hostile attribution score (α = .80) versus a benign attribution score (α = .67). The sentences were presented in randomized order. To calculate hostile attribution bias, the benign attribution score was subtracted from the hostile attribution score such that higher scores represent stronger hostile attribution bias.

Need for Cognitive Closure. Need for cognitive closure was measured using the NFC-15, a 15-item scale with five sub-facets: preference for order, predictability, and decisiveness, the tendency to avoid ambiguity, and closed-mindedness (Roets & van Hiel, 2011). The scale uses Likert-style response items on a scale from 1 (strongly disagree) to 7 (strongly agree), α = .89).

Results & Discussion

Hostile Attribution Bias. Using linear regression to test our hypotheses, we find that stronger zero-sum mindset predicts heightened perception of hostility in a simple linear regression (β = .25, 95% CI [.18 , .32], SE β = .03, t = 7.35, $F(1,819)$ = 54.07, adj. R^2 = .06, $p < .001$), and this relationship remains significant when controlling for demographic variables: sex, age, income, and political orientation in a multivariate regression (β = .20, 95% CI [.13 , .27], SE β = .04, t = 5.59, $F(7,812)$ = 11.31, adj. R^2 = .08, $p < .001$).

Need for Cognitive Closure. We find that zero-sum mindset also predicts stronger need for cognitive closure. (β = .28, 95% CI [.22 , .34], SE β = .03, t = 9.24, $F(1,819)$ = 85.34, adj. R^2 = .09, $p < .001$); and this relationship remains significant when controlling for demographic variables: sex, age, income, and political orientation (β = .27, 95% CI [.21 , .34], SE β = .03, t = 8.70, $F(7,812)$ = 19.95, adj. R^2 = .14, $p < .001$). A correlation matrix of zero-sum mindset measures and need for closure sub-facets is presented in Table 1. While most correlations are moderate, the relationship with closed-mindedness is moderately strong, and only the relationship with the need for order sub-facet is non-significant.

Table 1

Means, standard deviations, and correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4	5
1. Zero-Sum Mindset	3.05	1.35					
2. Ambiguity	4.84	1.20	.23** [.16, .29]				
3. Order	5.35	1.15	.06 [-.01, .13]	.46** [.40, .51]			
4. Predictability	4.88	1.22	.18** [.11, .24]	.72** [.68, .75]	.55** [.50, .60]		
5. Closed-mindedness	3.68	1.26	.44** [.38, .49]	.54** [.49, .58]	.30** [.23, .36]	.48** [.43, .53]	
6. Decisive	4.98	1.07	.27** [.20, .33]	.56** [.51, .61]	.41** [.35, .47]	.52** [.47, .57]	.45** [.39, .50]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. * indicates $p < .05$. ** indicates $p < .01$.

It is important to note that it is likely that hostile attribution bias, need for cognitive closure, and zero-sum mindset will exert mutual influence upon one another, with increases in one leading to concomitant increases in the others. But whatever the order of causality, the interaction of these general perceptual processes promises to thwart cooperation and exacerbate hostility across all kinds of social relationships.

How Zero-Sum Mindset Undermines Political Cooperation

One of the most essential forms of cooperation in a democratic society is a shared commitment to the democratic process. Democratic societies are built upon a fundamentally non-zero-sum relationship between citizens wherein safeguarding liberty and justice for all depends upon a commitment to democratic processes and institutions over and above our commitment to one's individual or group political goals. Therefore, a zero-sum mindset may bear negative consequences for the operations and practices of a democracy.

While many elections for political office are zero-sum in nature (in order for one candidate to win another has to lose), effective policy is not. Meaningful differences in values, priorities, and approaches to policy notwithstanding, residents and citizens in a society ultimately have far more interests that are shared rather than opposed (Van Boven, Judd, & Sherman, 2012). Operating from this basic principle, a non-zero-sum view of political efficacy relies upon serving these shared interests through both cooperation and negotiation.

In contrast, a zero-sum view of political efficacy is essentially hierarchical, and relies on political dominance rather than political cooperation to achieve political goals. This motivation for more

hierarchical, anti-egalitarian structuring of society is known as social dominance orientation, and is considered a strong predictor of authoritarian and racist attitudes (Pratto, Sidanius, & Levin, 2006). Thus, social dominance orientation is antithetical to democratic principles and democratic functioning. Indeed, in a cross-cultural meta-analysis of 27 societies, Fischer, Hanke, & Sibley (2017) found a strong negative correlation between mean levels of social dominance orientation and democratization.

Sidanius and Pratto suggest that at the heart of social dominance orientation is "...a view of human existence as zero-sum and relentless competition..." (Sidanius, Pratto, & Bobo, 1994, p. 999). Beyond anti-egalitarian preferences, a zero-sum construal of the relationship between members of different political groups can increase the perception of outgroup hostility, thereby eroding willingness to cooperate and prompting "reciprocal" hostility that degrades intergroup relations and collective success still further.

In a democratic society, hostility and cooperation can be both interpersonal and institutional. Interpersonal hostility may manifest in physical or verbal harassment of members of the other party, or conversely, interpersonal cooperation may look like a willingness to work together and commitment to understanding the other's perspective. Institutionally, the essential form of cooperation is commitment to the democratic process itself, which means protecting free and fair elections and voting rights. Hostility, in this sense, manifests as voter suppression or a willingness to compromise the integrity of the democratic process in order to forcefully, perhaps even violently, bring about a particular political goal.

We predicted that a zero-sum mindset undermines democracy through reduced commitment to the democratic ideals of equality and fairness (social dominance orientation) and to the democratic process itself, and increases willingness to use forceful, even violent, tactics against political outgroups, both institutionally and interpersonally. We tested these hypotheses across three studies.

Study 1b

In Study 1b, we hypothesized that a stronger zero-sum mindset would predict stronger social dominance orientation and stronger support for interpersonal hostility rather than cooperation with political outgroup members.

Method
Participants & Procedure. Eight hundred and twenty-one U.S. residents completed the study (70% White, 13% Black/African American, 5% Asian/South Asian, 6% Latin/Hispanic, and 6% Other; 52% female; Ages ranged 18-72, M_{age} 34.54, SD = 10.66). Participants were recruited using Amazon Mechanical Turk (MTurk). The questionnaire was administered online and took about 11 minutes to complete. Participants who completed the survey received a code they could redeem for a $2.00 reward on MTurk.

Measures.

Zero-sum mindset. Zero-sum mindset was measured using the same 5-item measure used in Study 1a.

Social dominance orientation. Social Dominance Orientation was measured using the SDO-7 (Ho et al., 2012), an eight-item Likert-style scale. (Example item: "An ideal society requires some groups to be on top and others to be on the bottom.") Responses to the ranged from strongly disagree (1) to strongly agree (5) ($\alpha = .86$).

Hostility towards political outgroup members. To measure support for aggressive behaviour towards outgroups, participants were first provided with a short list of right-leaning and left-leaning groups (Republicans, Democrats, conservatives, liberals, Trump supporters, social justice activists) from which they could select the group with which they identified most and the group with which they identified least. They then rated an inventory of behaviours by a member of their ingroup that included various types of aggression (e.g., "Sending an anonymous threatening message to a Democrat") or cooperation (e.g., "Working together with a Republican to solve a shared problem") towards members of their chosen outgroup on a scale from strongly oppose (1), slightly oppose (2), slightly support (3), and strongly support (4). The full inventory consisted of 22 items ($\alpha=.92$) that described physical, social, epistemic, and economic forms of aggression and cooperation, with 8 reverse-coded cooperation items, 14 aggression items.

Results and Discussion

In line with our hypotheses, we found that zero-sum mindset predicts a stronger preference for group-based dominance and inequality, and support for hostile rather than cooperative behaviour towards political outgroups. The means, standard deviations and zero-order correlations of the variables are presented in Table 2.

Table 2

Means, standard deviations, and correlations with confidence intervals (N = 822)

Variable	M	SD	1	2	3	4	5	6
1. Zero-Sum Mindset	3.05	1.35						
2. Social Dominance Orientation	2.74	1.19	.35** [.29, .41]					
3. Hostility toward political outgroups	-0.77	0.81	.38** [.32, .44]	.17** [.11, .24]				
4. Age	34.58	10.66	-.19** [-.26, -.13]	.02 [-.04, .09]	-.13** [-.19, -.06]			
5. Sex	1.50	0.51	-.13** [-.19, -.06]	-.21** [-.27, -.14]	-.15** [-.22, -.08]	.01 [-.06, .08]		
6. Income	6.11	3.06	-.12** [-.19, -.05]	.08* [.01, .15]	-.05 [-.11, .02]	.03 [-.04, .10]	-.04 [-.11, .03]	
7. Education	4.32	1.42	.08* [.01, .15]	.07* [.00, .14]	.10** [.04, .17]	.03 [-.04, .10]	-.07* [-.14, -.00]	.29** [.23, .35]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. * indicates *p* < .05. ** indicates *p* < .01.

We also used linear regression to control for demographic variables with established relationships to social dominance orientation: sex (identifying as female predicts lower social dominance orientation) and income (higher income predicts stronger social dominance orientation), in addition to age and education. When controlling for these variables we find that the relationship between zero-sum mindset and social dominance orientation is essentially unchanged if not slightly suppressed by demographic variables (*beta* = *p* <.001). Similarly, when controlling for sex, income, age, and education, zero-sum mindset still robustly predicts hostility instead of cooperation with political outgroups (*beta* = .35, *p* <.001).

Study 2

In study 2, we hypothesized that a zero-sum mindset would predict lower commitment to democratic process, equal voting rights, and ethical behaviour and fairness in politics. Furthermore, we hypothesized that those with a zero-sum mindset would be more likely to endorse the use of violence to achieve political goals.

Method

Participants & Procedure.
Three hundred US residents were recruited on the Prolific platform using pre-screening to recruit an even number of members of the major opposing political parties, 150 participants who identified as Republicans and 150 who identified as Democrats. Two-hundred and nineteen

(73%) identified as white, 38 (13%) as Asian, 19 (6%) as Latinx/Hispanic, 17 (6%) as black or African American, 1 (>1%) as Indigenous/Native American, and 6 (2%) as other; 50% identified as female; Ages ranged 18-76, M_{age} 34.69, SD = 13.07. The survey was administered online and took about 4 minutes to complete. Participants who completed the survey were given a code they could redeem on Prolific for £0.60.

Measures.
Zero-sum mindset. Zero-sum mindset was measured using a seven-item scale comprising the five items used in Study 1 along with an additional two reverse-key items to help balance the scale for acquiescence (α = .86). See Appendix for details.[6]

Commitment to Equal Voting Rights. Commitment to equal voting rights was measured using five Likert-style items (example: "I would defend the right of my political opponents to vote"). Response options ranged from strongly disagree (1) to strongly agree (7) (α = .80).

Commitment to Democratic Process over political goals. Commitment to democratic process was measured using six Likert-style items (example: "Protecting the democratic process is more important than my particular group's political goals"). Response options ranged from strongly disagree (1) to strongly agree (7) (α = .79).

Willingness to use violence. Willingness to use violence was measured with two items, one positive-key: "Violence is sometimes needed to achieve important political goals" and one reverse-key: "Violence is never the way to achieve important political goals." Response options ranged from strongly disagree (1) to strongly agree (7). (Item correlation = .69).

Results & Discussion
As predicted, we find that a zero-sum mindset is negatively correlated with commitment to voting rights, and positively correlated with willingness to compromise the democratic process for political gain and willingness to use violence (Table 3). Furthermore, these results all remain essentially unchanged when using linear regression to control for political orientation, sex, age, income, and education (all *p's < .005*).

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[6] Studies with repeated measures that used the original 5-item measure in the first instance continued to employ this measure. After testing reverse-key items and finding evidence for reduction in acquiescence, the 7-item measure with reverse-key items was employed thereafter.

Table 3

Means, standard deviations, and correlations with confidence intervals (N = 300)

Variable	*M*	*SD*	1	2	3
1. Zero-Sum Mindset	2.77	1.10			
2. Commitment to voting rights	5.71	1.09	-.28** [-.38, -.18]		
3. Willingness to compromise democratic process for political gain	2.78	1.08	.41** [.31, .50]	-.62** [-.68, -.54]	
4. Willingness to use violence to achieve political goals	2.57	1.57	.20** [.09, .30]	-.30** [-.40, -.20]	.54** [.46, .62]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. * indicates *p* < .05. ** indicates *p* < .01.

Study 3

In study 3, we investigated possible mechanisms by which a zero-sum view of the world can weaken commitment to democracy and willingness to use violence. We predicted that a zero-sum mindset predisposes one towards a zero-sum construal of the relationship between members of different political groups, and that these proximal zero-sum beliefs would lead to increased hostility towards political outgroup members and increased willingness to compromise the democratic process in order to make political gains.

Method

Participants & Procedure.

Using pre-screening to recruit an even number of members of the major opposing political parties, 455 US residents were recruited for the online study. Three hundred and fifty-one (77%) identified as white, 37 (8%) as Asian, 31 (7%) as black/African American, 23 (5%) as Latinx/Hispanic, 2 (>1%) as Indigenous/Native American, and 11 (2%) as other; 56% identified as female; Ages ranged 18-73, M_{age} 34.39, SD = 12.98. The survey was administered online and took about 7 minutes to complete. Participants who completed the survey were given a code they could redeem on Prolific for £0.90.

Measures.

Zero-sum mindset. Zero-sum mindset was measured using a seven-item scale used in Study 2.

Zero-sum beliefs about political group relationships. As in Study 2, participants were first provided with a short list of right-leaning and left-leaning groups from which they could select the group with which they identified most and the group with which they identified least. These identifiers were then inserted into a series of Likert-style items describing the relationship between the selected ingroup and outgroup members in zero-sum terms (example: "What is good for liberals means harm for Trump supporters") and non-zero-sum terms (example: Democrats and Republicans have the same ultimate goals"). Response options ranged from strongly disagree (1) to strongly

agree (7) (α = .82).

Hostility towards political outgroups. The same measure used in Study 1b was used to measure support for aggression instead of cooperation with political outgroup members.

Commitment to Equal Voting Rights. We employed the same measure of commitment to equal voting rights that was used in Study 2.

Results

Our results (Table 4) suggest that the relationship between zero-sum mindset and commitment to voting rights is partially mediated by a willingness to compromise democracy in order to "win". We find a significant negative relationship between zero-sum mindset and commitment to voting rights (*beta* = -.34, p <.001) and also between value for winning over democracy and commitment to voting rights (-.51, p <.001). The standardized indirect effect = -.17. We tested the significance of this indirect effect using bootstrapping procedures. Unstandardized indirect effects were computed for each of 10,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was -.17, and the 95% confidence interval ranged from -.23, -.11. Thus, the indirect effect was statistically significant indicating a mediation effect.

Table 4: Valuing winning over democracy mediates the relationship between zero-sum mindset and commitment to voting rights

Parameter estimates

Direct effects

			Estimate	Std. Error	z–value	p	95% Confidence Interval	
							Lower	Upper
zsm_mean	→	voting_rights_mean	−0.168	0.043	−3.950	< .001	−0.274	−0.069

Note. Delta method standard errors, bias–corrected percentile bootstrap confidence intervals, ML estimator.

Indirect effects

					Estimate	Std. Error	z–value	p	95% Confidence Interval	
									Lower	Upper
zsm_mean	→	winning_over_democracy	→	voting_rights_mean	−0.166	0.025	−6.647	< .001	−0.228	−0.114

Note. Delta method standard errors, bias–corrected percentile bootstrap confidence intervals, ML estimator.

Total effects

			Estimate	Std. Error	z–value	p	95% Confidence Interval	
							Lower	Upper
zsm_mean	→	voting_rights_mean	−0.334	0.044	−7.622	< .001	−0.446	−0.229

Note. Delta method standard errors, bias–corrected percentile bootstrap confidence intervals, ML estimator.

Our results (Table 5) also indicate that the relationship between zero-sum mindset and aggression towards political outgroup members is mediated by specific zero-sum beliefs about the relationship between members of different political parties. We find a significant positive relationship between zero-sum mindset and aggression (*beta* =.14, p = .002), and also between specific zero-sum beliefs and aggression (*beta* = .47, p <.001). The standardized indirect effect

was = .07. We tested the significance of this indirect effect using bootstrapping procedures. Unstandardized indirect effects were computed for each of 10,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was .06, and the 95% confidence interval ranged from .03, .10. Thus, the indirect effect was statistically significant indicating a mediation effect.

Table 5: Mediation 2: Specific Zero-Sum Beliefs About Relationship with Outgroup Members Mediates the Relationship between Zero-Sum Mindset and Hostility Towards Outgroup

Parameter estimates

Direct effects

			Estimate	Std. Error	z–value	p	95% Confidence Interval Lower	Upper
zsm_mean	→	agg_coop_mean	0.048	0.033	1.464	0.143	−0.033	0.126

Note. Delta method standard errors, bias–corrected percentile bootstrap confidence intervals, ML estimator.

Indirect effects

					Estimate	Std. Error	z–value	p	95% Confidence Interval Lower	Upper
zsm_mean	→	zsg_polarization_mean	→	agg_coop_mean	0.063	0.017	3.621	< .001	0.030	0.102

Note. Delta method standard errors, bias–corrected percentile bootstrap confidence intervals, ML estimator.

Total effects

			Estimate	Std. Error	z–value	p	95% Confidence Interval Lower	Upper
zsm_mean	→	agg_coop_mean	0.111	0.036	3.071	0.002	0.033	0.186

Note. Delta method standard errors, bias–corrected percentile bootstrap confidence intervals, ML estimator.

How Zero-Sum Mindset Undermines Economic Cooperation

In Adam Smith's, *The Wealth of Nations* (1776)*,* one of the central themes is a rejection of mercantilism, essentially a zero-sum view of trade in which exports are seen as gains and imports as losses. Growth through specialization and trade, whether between individuals or collectives, is built upon a non-zero-sum view of the world. While economists may take this for granted, a zero-sum view of trade persists in the form of trade wars, which aim to protect domestic interests but can also stifle growth and inflict costs for both the rich and the poor (Borusyak & Jaravel, 2018). In a liberal democracy, lay theories of economics can influence economic policy and economic behaviour as much or more than academic theory. So despite economists' warnings against the "zero-sum fallacy," it has been argued that zero-sum thinking is the foundation of folk economic theory (Rubin, 2003), that is, Rubin suggests that the default view of untrained economic thought is a failure to conceive of non-zero-sum economic growth.

Correlational evidence supports the relationship between zero-sum thinking and economic success. Różycka-Tran and colleagues find a negative correlation between zero-sum thinking and economic success at both the macro-level, measured as national GDP, and micro-level, measured as household income (Różycka-Tran et al., 2015, 2019). The authors primarily interpret these findings to suggest that economic failure gives rise to zero-sum beliefs: "The zero-sum game belief provides an easy and self-serving way to explain one's

own failures" (2015). As this is correlational evidence, it is possible that the causality may *also* flow in the opposite direction, with stronger zero-sum beliefs deteriorating the trust and cooperation that lead to economic growth over time. We investigated this overarching hypothesis and several potential mechanisms in studies 4 - 7.

Study 4

Because a zero-sum mindset is predisposed to perceive resources as fixed, those with a zero-sum mindset may neglect opportunities to expand value through cooperation with other groups. However, the processes underlying such decision-making are poorly understood.

One possible mechanism may be the generalized tendency for those with a zero-sum mindset to hold a more myopic view of the world. A recent study by Johnson, Zhang & Keil (2018) proposes that zero-sum appraisals of market exchanges result from failures in perspective-taking. Such failures of perspective taking when present in every domain of a person's life are taken to be a feature of certain neurological configurations (see Baron-Cohen, Tager-Flusberg & Lombardo, 2013), but this does not mean that someone who is capable of it does so in every situation. It has been shown to help people find the "win-win" scenarios in economic relationships that can foster cooperation and create value (Galinsky et al., 2008). In this way, a social-cognitive disposition may also lead to economic deficits. This hypothesis is also supported by our earlier findings in Study 1a, which demonstrated a strong relationship between zero-sum mindset and closed-mindedness.

Another possible mechanism may stem from the zero-sum mindset's preoccupation with dominance. In Axelrod's famous simulations, computer programs with predetermined strategies competed in a repeated prisoner's dilemma tournament (Axelrod & Hamilton, 1981). One of the key findings was that the most successful strategy was actually rarely dominant within any single round, but in the long run (the accumulation across many rounds with many players) it outstripped its competition through steady accumulation of the benefits of cooperation. In the same way, a preoccupation with short-term dominance instead of cooperation may lead to some small "wins" whilst hindering the cooperation that leads to sustained growth over time.

As demonstrated by results from Study 1b those who are higher in zero-sum mindset demonstrate a stronger drive for dominance. Therefore, those who are higher in zero-sum mindset may be more preoccupied with increasing their own relative advantage over others rather than in finding ways to grow the total amount of resources available for all through cooperation.

In this study, we investigated this hypothesis using an online experiment in which participants were randomly assigned to either a "perspective-taking" or "objective" manipulation condition followed by an economic decision-making task designed to elicit competing motives for growth of total resources or dominance. In the task, participants can allocate money in a way that either maximizes their own group's relative advantage over another group while keeping total resources fixed or they could opt for more egalitarian allocations between groups that would grow total resources up to 150% and promote potential future cooperation.

We hypothesized that a zero-sum mindset would predict more self-serving allocations across conditions, giving their group a higher relative payoff compared to the other group, but producing lower total value. We also predicted that while perspective-taking would lead to more equal distributions and higher community investment in general, those with a strong zero-sum mindset would avoid perspective-taking and instead be more motivated by their relative advantage rather than by expanding total value through cooperation.

Method

Participants and Procedure. One hundred and ninety-nine United Kingdom residents (157 English, 19 Scottish, 4 Welsh, 3 Northern Irish, 16 declined to specify; 71% female; ages ranged 18-70, M_{age} = 34.62, SD = 11.17) completed the study. Participants were recruited using the Prolific platform and were paid £1.04 to complete the online study which took about 8 min. Participants first completed measures of zero-sum mindset, then received either the "empathic" or "objective" perspective manipulation instructions respective of condition. In the empathic condition, participants were instructed to "try to take the perspective of the other group by imagining as vividly as possible how the other group might think and feel." In the objective condition, participants were instructed to "Try to imagine as vividly as possible while taking an objective perspective towards what is described, and not get caught up in how either group may feel." Participants then completed the economic decision-making task followed by manipulation check measures and trait empathy measures.

Measures.

Zero-Sum Mindset. We used the zero-sum mindset measure used in Study 1.

Empathic Efficacy. Immediately following the economic decision-making task, participants were asked to report to what extent they understood the other group's perspective (cognitive empathy) on a scale from "Not at all" (1) to "Completely" (4), and the extent to which they felt what the other group might have felt (affective empathy) on a scale from "Not at all" (1) to "Felt strongly" (4) during the decision-making task. As a measure of the degree to which one may be anchored to their own perspective, we also asked participants to rate the same items, but for their own group's perspective and emotions.

Economic Decision-Making Task. Participants were instructed to read a hypothetical scenario and make a decision about how they would allocate money in an economic game. The scenario described a situation in which two groups, their group and "another group," are participating in the same research, but only one of the groups is randomly chosen to receive £100. The group given the money can choose to allocate all, some, or none of the money into a "community pot" that will then be multiplied by 1.5 and shared equally. They are then told that their group is being given the money, but that there is the possibility, but not a guarantee, of future rounds in which the other group could be given more or less money. This decision-making task combines elements of the "dictator" game in which one group is given all of the decision-making power to advantage their own group, and the "community goods" games in which there is an opportunity to grow the total resources available for all through cooperation.

Participants were then asked to write down their thoughts—describing how they will decide to allocate the money, and finally to indicate their decision. Allocation choices range from the most equal distributions (5) and largest growth to the most unequal (and self-serving) with no total growth (1) as indicated in the pay-out schedule shown to participants below.

Option	Keep/into pot (£)	Total to Share	Your group get	The other group get
1	100/0	£100	£100	£0
2	75/25	£112.50	£93.75	£18.75
3	50/50	£125	£87.50	£37.70
4	25/75	£137.50	£81.25	£56.25
5	0/100	£150	£75	£75

Results

To test the main effect of empathy on economic allocations, we conducted a linear regression analysis predicting allocation choice from self-reported manipulation efficacy, condition, and the interaction between the two. As predicted, we find a significant main effect of empathy (self-reported empathic efficacy) on allocations such that those who report empathizing with the other group more strongly made less self-serving allocations and higher investment in the community pot ($\beta = .50$, 95% CI [.29, .70], SE $\beta = .11$, $t = 4.76$, $p < .001$). We also find the expected interaction effect (interaction term: $\beta = .40$, 95% CI [-.67,-.13], SE $\beta = .14$, $t = 2.89$, $p < .01$) such that the relationship between empathy and more egalitarian allocation choice is significantly stronger in the "empathic" manipulation condition than in the "objective" condition (See Figure 2).[7]

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[7] While those in the perspective-taking condition reported higher empathy for the outgroup compared to the objective condition ($t = 2.23$, $p = .03$) and invested more in the community pot, this difference in allocation choice between groups was non-significant ($\beta = .10$, $t = .69$, $p = .49$). Although the relationship between empathic efficacy and community investment was stronger in the empathy condition, the proposed mechanism, empathic efficacy, predicts higher investment in the community pot across *both* conditions.

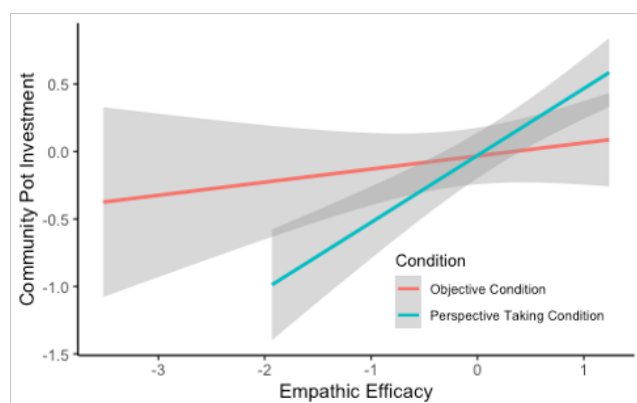**Figure 2: Interaction of condition and empathy on allocation decision**

Figure Notes: Units are standardized units. Higher community pot investment represents more egalitarian allocation choice.
Shaded area = 95% CI.

To test the hypothesis that zero-sum mindset will predict more self-serving allocations and lower investment in the community pot across conditions, that is, without respect to the empathy induction, we conducted a multivariate linear regression analysis predicting allocation choice from mean zero-sum mindset with condition as a covariate. As predicted, we find that zero-sum mindset predicts less egalitarian allocations across conditions (β = -.18 , 95% CI [-.32,-.04], SE β = .07, t = 2.53, p = .01, F(2,196) = 3.44 , adj. R^2 = .02).

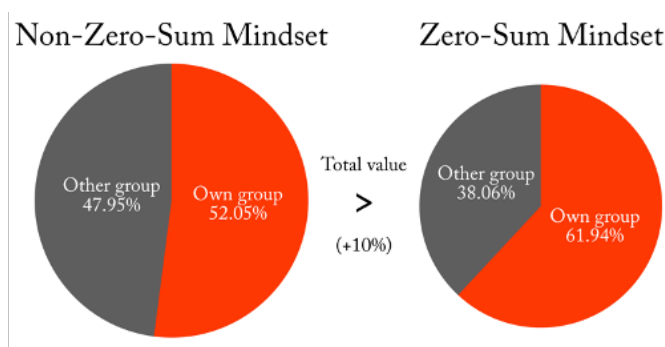**Figure 3: Allocation Selection Outcomes by Mindset**

Figure Notes: Percentages represent mean distribution of resources according to participant allocation selection. Charts drawn to scale to represent 10% less value generated by those with zero-sum mindset.

According to the pay-out schedule, this translates to about 10% lower total value in a single round generated by those with a high zero-sum mindset (+1 SD above mean zero-sum mindset) compared to the value created by those with a low zero-sum mindset (-1 SD below mean zero-sum mindset). See Figure 3.

This effect appears to be partially explained by empathy such that when including mean empathy as a covariate with zero-sum mindset, both remain significant at the p < .05 level. In this model, empathy predicts higher investment, and zero-sum mindset predicts lower investment in the community pot. When we consider cognitive and affective empathy separately, we find that zero-sum mindset only predicts deficits in cognitive empathy, not affective empathy, and only when directed towards the outgroup. That is, those with a stronger zero-sum mindset demonstrate weaker understanding of the other group's perspective, but stronger understanding for their ingroup's perspective, which also predicts more self-serving allocations when controlling for

empathy towards the outgroup (β = -.20 , 95% CI [-.33,-.06], SE β = .07, t = -2.86, F(2,196) = 12.12 , adj. R^2 = .10, p = .005). This aligns well with previous results demonstrating those with zero-sum mindset have higher need for cognitive closure, which can motivate one to "seize" and "freeze" on their own group's perspective and resist the perspective of others (Kruglanski & Webster, 2018).

Discussion

These results demonstrate that when making decisions, those with a zero-sum mindset are more likely to prioritize their own relative advantage rather than the cooperation that could expand the total amount of resources available for all. However, this study has several limitations. Firstly, because the allocation decisions were hypothetical, participants may represent their preferences differently from preferences demonstrated in choices with real, personal consequences. Secondly, in the design of this task, motives for growth and equality are intertwined and so it is unclear whether those with a zero-sum mindset simply undervalued total growth in favour of individual benefit, or whether preference for an advantage relative to the other group was driving choices. These limitations will be addressed in Studies 8 - 9.

While these choices may provide an advantage for participants with full decision-making power in a single round, when played out over time, those who are more willing to invest in cooperation tend to "grow the pie" both for themselves and for others more than those who do not (Axelrod & Hamilton, 1981). Similar patterns are found in the real world across individuals and societies, such that those that cooperate and invest in community resources, are more likely to flourish over time (Tov & Diener, 2009). This could mean that a zero-sum strategy that seems to promise higher status in the short-term, could in fact lead to lower status in the long-term. This is the hypothesis we tested in Study 5.

Study 5

In Study 5, we conducted a prospective study examining changes in zero-sum mindset, income, and subjective status over time.

We hypothesized that zero-sum mindset at Timepoint 1 would predict lower objective economic status (income) at Timepoint 2 (controlling for baseline income at Timepoint 1), as well as lower subjective status at Timepoint 2 (not measured at Timepoint 1). We further hypothesized that perceived changes in subjective status will predict changes in zero-sum mindset such that those who perceive themselves to be declining in status over the past year will report increases in zero-sum mindset.

Method

Participants & Procedure.

Ten months after the initial data collection in Study 1, all participants who successfully completed Study 1 were invited to participate in this study (contacted via TurkPrime which allows for participants to be contacted via email whilst remaining anonymous to the research team). To incentivize higher retention an additional completion bonus was offered, making the

total $1.25 for the 5-minute survey. Forty-three percent of the participants from Timepoint 1 also completed measures at Timepoint 2 (for a total N = 353 participants, n = 706 observations used for analysis). Participants were 72% White, 10% Black/African American, 6% Latin/Hispanic, 5% Asian/South Asian, and 7% Other; 54% female; Ages ranged 18-72, M_{age} 36.97, SD = 12.12. We compared participants who completed both surveys with those who only completed the first survey to ensure that there were no systematic differences in the population samples. We found no significant differences in these participants in terms of baseline income, education, sex or age.

Measures.

Income. Participants reported their current total household income $USD at both Timepoint 1 and Timepoint 2 on a scale from less than $10,000 to $200,000+. Participants' reported income ranged from less than $10,000 to $200,000+ with a median reported income of $55,000 at Timepoint 1.

Subjective Status. Subjective status and dynamic subjective status were measured using the MacArthur Subjective Socioeconomic Status scale. The scale uses an image of a ladder to represent where people stand relative to others (in this case, the United States) in terms of status, with those at the top (9) having the most wealth and respect, and those on the bottom having the least (1) and asks participants to indicate where on the ladder they see themselves.

Dynamic Subjective Status. Dynamic Subjective Status was measured using a modified version of this scale in which participants are asked to rate their perceived relative status when thinking back to different times in their life (e.g., "right now" and "one year ago"). Perceived dynamic status was calculated as the difference in ratings between the ratings for current and past status such that higher numbers represent perceived growth in status and negative numbers represent perceived decline in status over the past year.

Results and Discussion

Subjective socioeconomic status. Zero-sum mindset at Timepoint 1 predicts lower subjective socioeconomic status 10 months later at Timepoint 2. (β = -.18 , 95% CI [-.28,-.08], SE β = .05, t = -3.45, p<.001, F(1,351) = 11.87 , adj. R^2 = .03, p < .001).

Objective economic status (Income). Using multiple linear regression, we tested whether zero-sum mindset would lead to worse economic outcomes over time (N = 353 unique participants observed at two Timepoints separated by 10 months). As predicted, we found that stronger zero-sum mindset at Timepoint 1 predicted lower income at Timepoint 2 controlling for baseline income (β = -.07, 95% CI[-.11, -.02], SE β = .02, t = -2.90, p = .004). To test the robustness of this relationship we also controlled for the number of household members, number of household wage earners, sex, race, educational attainment, and parental educational attainment, and found that the relationship was virtually unchanged (β = -.06, 95% CI[-.11, -.02], SE β = .02, t = -2.60, p = .009). We also tested whether the relationship between change in income and zero-sum mindset would be better explained prospectively or retrospectively by comparing the predictive power of our measures of zero-sum mindset at both Timepoints 1 and

2. We found that when zero-sum mindset at Timepoint 2 is added as a covariate, only zero-sum mindset at Timepoint 1 remains a significant predictor of change in income (β = -.07, p =.04), while zero-sum mindset at Timepoint 2 becomes non-significant (β = -.001, p = .98). While more research is needed to make stronger causal inferences, this evidence suggests that a zero-sum mindset may contribute to declines in income over time.

Recursive processes. Having found that zero-sum mindset can lead to lower objective and subjective status over time, we then tested whether experiencing declining status will lead to changes in zero-sum mindset, as predicted by our hypothesis that zero-sum mindset can lead to recursive processes that reinforce the mindset. In order to test this, we examined whether perceived changes in status might also lead to higher zero-sum mindset over time. Although in general zero-sum mindset appears to be relatively stable (10-month test-retest correlation = .67, p <.001), we still find that perception of declining status predicts modest increases in zero-sum mindset at Timepoint 2 when controlling for zero-sum mindset at Timepoint 1 (β = .09, 95% CI [-.17, -.02], SE β = .04, t = 2.42, p = .02). Interestingly, only subjective, not objective changes (e.g., changes in income or education) in status predicted changes in zero-sum mindset. In other words, while *subjective* perceptions of decreasing status might lead to a stronger zero-sum mindset, a stronger zero-sum mindset may eventually lead to *objective* decreases in socioeconomic status.

Exploring potential mediators. We also explored the data for potential confounds or mediators of the relationship between zero-sum mindset and lower income over time. One of the only other significant predictors of change in income in our data was trust. While personal forms of trust in family and friends had only trending relationship to change in income (beta = .03, p = .09), institutional and general forms of trust such as trust in business, trust in government, trust in the justice system, and trust in strangers, were somewhat stronger predictors (institutional trust *beta* =.06, p = .007) and appear to at least partially mediate the relationship between zero-sum mindset and trust. This finding is in keeping with the broader literature which finds trust as an essential component of economic growth (Fukuyama, 1995), but exactly how a zero-sum mindset might lead to lower trust has not been investigated. The relationship between zero-sum mindset and trust is investigated further in Studies 6-9.

How Zero-Sum Mindset Undermines Trust

There are myriad definitions of, and methods for studying trust in surveys, the laboratory and the real world. Trust is a critical component in the interpersonal relationships that are essential to subjective wellbeing (Rempel, Holmes, & Zanna, 1985), in the establishment of wider social cohesion and institutional health and democracy (Good, 1988; Portela, Neira, & Salinas-Jiménez, 2013; Tov & Diener, 2009) and in the economic relationships that foster trade and individual and societal economic growth (Lim, Morshed, & Khun, 2018; Pagden, 1988). Across many disciplines and definitions of trust, it has been well-established that trust is essential to human flourishing, but equally that it is something which if misplaced can be damaging too. If trust is given to the trustworthy then the former holds. What we are directed towards in those circumstances is the interpersonal nature of the condition and the ways in which each party's

behaviour is understood by the other. A zero-sum mindset makes the conditions for it occurring much harder to achieve because of the perceptual and behavioural bias which results.

Typically, definitions of trust entail the notion of *expectation.* Expectation that the trusted person or institution can and/or will do something needed or desired by the trustor within a certain context. This is particularly the case in how the concept is operationalised in the psychological literature where the focus is typically on self-reported trust or behavioural trust as measured in the classic "trust game." As art of that operationalisation, it is widely accepted that trust exists along two-dimensions: warmth and competence. In essence, appraisals of warmth determine whether one means you well or means you harm, and appraisals of competence determine whether they can actually do what is promised or threatened (Fiske, 2018). Similarly, trust in institutions has been found to comprise two essential elements: ethical conduct, akin to warmth, and effectiveness, akin to competence (Edelman Intelligence, 2018).

Operationalisations of trust as *self-reported appraisals of the internal characteristics,* of people and institutions, and are sometimes referred to as person-centred theories of trust (e.g. How much would you say most people can be trusted?) (Naef & Schupp, 2011). These methods do not prescribe the specific criteria that determine trust, but instead capture the respondent's general perception of the trustworthiness of various targets (perhaps a specific person or institution, or people and institutions generally). While these self-reported measures don't require any actual trusting behaviour, these self-report indicators are valuable sources of understanding trends and patterns in the formation and deterioration of trust (Lewicki & Brinsfield, 2011; Smith, Tom W., Davern, Michael, Freese, Jeremy, and Morgan, General Social Survey, 1972-2018)

When the focus is on trusting *behaviour,* most notably in the classic "trust game" paradigm (Alós-Ferrer & Farolfi, 2019; Berg, Dickhaut, & McCabe, 1995; Johnson & Mislin, 2011), there is an important additional dimension: vulnerability (Mayer, Davis, & Schoorman, 1995). The typical format of a two-player trust game is as follows:

Two players are designated to be either the trustor or the trustee. The trustor, Player 1, is given an endowment of something of value (often money), and must choose how much, if any, of this endowment to send to Player 2, the trustee. The transfer to Player 2 is then multiplied by a given factor (usually doubled or tripled). Player 2 then has the opportunity to return some of this magnified amount back to Player 1. Critically, however, the trustee (Player 2) is not obligated to return any of this multiplied value back to the trustor (Player 1). Thus, the trustor's initial transfer represents an act of trust by making vulnerable something of value with the expectation that the other player will be trustworthy by sharing the benefits of the original trusting action.

In other words, in this paradigm the best performative measure of trust is the degree of vulnerability that can be tolerated because of trust. In the trust game, this takes the form of the "sending" or "giving" money or something else of value to a trustee with an expectation, but not a guarantee, that some portion of the money will be returned.

Even though behavioural measures like the trust game will still depend heavily upon the trustor's appraisal of the other player's trustworthiness (just as in the survey measures of trust), the

amount a player decides to send may also be informed by many other factors (Alós-Ferrer & Farolfi, 2019). One's willingness to become vulnerable through a trust behaviour may also be influenced by structural incentives, or more specifically, one's *appraisals* of those structural incentives.

For some, a strictly person-centred definition of trust will exclude these other external factors as determinants of trust, considering them confounds to the operationalization of trust. However, in our increasingly complex and global society, we often do not have enough information about those with whom we must interact in order to make such appraisals of their internal characteristics, and we must rely even more heavily upon other assurances and incentives in order to determine whether or not we will trust. For example, I might be able to "trust" my money with a particular bank not because I think them particularly ethical or competent, but perhaps because I know I have certain recourse, legally or reputationally, should they betray this trust. In this case, the behaviour, not the attitude is the measure of trust. In this investigation we employed both person-centred and behavioural operationalizations of trust in order to test the overarching hypothesis that zero-sum mindset erodes trust. Furthermore, we propose two possible mechanisms, not incompatible with one another, by which a zero-sum mindset may thwart trust.

Firstly, in a zero-sum world, everyone is a rival. That is, if another person's success requires your failure and you expect most people to seek their own success, then this entails that they seek your harm. Since perception of warmth is the primary driver of trust, a bias towards perceiving rivalry and hostility should also bias one away from trust.

Secondly, another essential feature of the zero-sum world is the belief in limited goods, or fixed scarcity. If one tends to see resources as relatively fixed, then one may also systematically underestimate the possibility of growth. While beliefs about the nature of scarcity should not directly influence beliefs about the *trustworthiness of others*, it may alter the calculus of trusting behaviour by reducing the *perceived incentives for trust*.

We test these hypotheses using self-reported measures of trust in Studies 6 - 7, and behavioural measures of trust in Studies 8 - 9.

Self-Reported Trust

Study 6

Hypotheses
We hypothesized that since a zero-sum mindset consists of a *generalized* view of the world, a zero-sum mindset would predict lower levels of trust across a broad range of domains rather than just within certain domains. In Study 5, we found that a zero-sum mindset predicted lower trust across a broad variety of targets 10 months later. In Study 6, we attempt to replicate these findings with a new sample and repeated measures at multiple timepoints.

Method

Participants & Procedure. Five hundred and four US residents completed the study, of which 329 (65%) identified their ethnicity as white, 42 (8 %) as Latinx/Hispanic, 36 (7%) as black/African/African American, 36 (7%) as Asian/South Asian, 9 (2%) as Jewish, 7 (1%) as Native American, and 46 (9%) as other or preferred not to respond. Fifty-six percent of participants identified as female. Participant ages ranged 18-70, M_{age} = 33.39, SD = 11.07. Participants were recruited using the Prolific platform. The questionnaire was administered online and took about 7 minutes to complete. Participants who failed a simple attention check (e.g., "Select Agree") were asked to return their submission to Prolific and their data was not used for analysis. Participants who completed the survey received a code they could redeem for £1 on Prolific.

Measures.

Key Variables.

Zero-Sum Mindset. Zero-sum mindset was measured using the same items selected from the *BZSG* used in Study 1.

Trust. Participants indicated their degree of trust on a scale from "No trust at all" (1) to "A lot of trust" (5). Degree of trust was rated for people in general (most people, strangers), interpersonal relationships (family, friends, neighbours), justice institutions (police, courts), government (local government, federal government), knowledge institutions (science, journalism), and business institutions (local businesses, large companies).

Control Variables.

Income. Participants reported their current total household income $USD on a scale from less than $10,000 to $200,000+. Participants' reported income ranged from less than $10,000 to $200,000+ with a median reported income of $50,000-$59,000.

Education. Participants reported the highest level of schooling they have completed on a scale from 1 (Less than high school degree) to 7 (Doctoral degree (PhD)/Professional degree (JD, MD)). Distributions of participants' educational attainment is represented in Figure 4.

Figure 4 - Distribution of Educational Attainment (*N = 504)*

Number of Participants
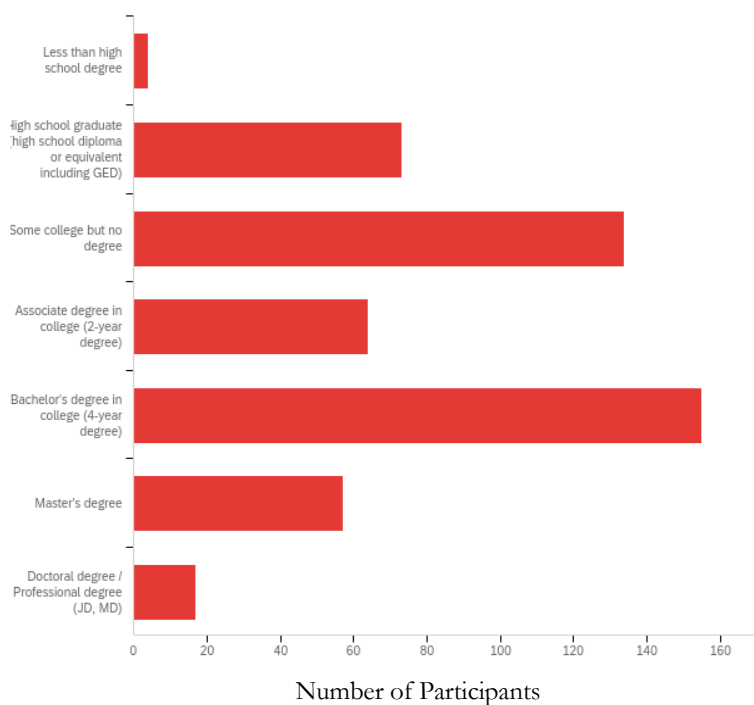
Results & Discussion

Across both studies we find that those with a stronger zero-sum mindset demonstrate deficits in self-reported trust across a broad range of trust domains. With the largest deficits in the domains where trust is usually strongest (trust in family and friends) and the smallest effects where trust is generally low across the broader population sample (trust in government). We also used linear regression to control for other variables widely regarded as key demographic determinants of trust: education and income. The relationship between zero-sum mindset and trust remained robust when including these control measures, and in most cases, zero-sum mindset was actually a stronger predictor of trust than these established variables which also serve as a useful benchmark for comparison. See Tables 6 - 12 for regression results for each composite measure of trust.

Table 6

Regression results using general trust as the criterion

Predictor	b	b 95% CI [LL, UL]	beta	beta 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	3.02**	[2.81, 3.22]						
Zero-Sum Mindset	-0.12**	[-0.17, -0.07]	-0.21	[-0.30, -0.13]	.04	[.01, .08]	-.24**	
Income	0.00**	[0.00, 0.00]	0.15	[0.06, 0.23]	.02	[-.00, .04]	.19**	
Education	0.03*	[0.00, 0.07]	0.09	[0.00, 0.18]	.01	[-.01, .02]	.15**	
								R^2 = .091**
								95% CI[.04,.14]

Table 7

Regression results using trust in most people as the criterion

Predictor	b	b 95% CI [LL, UL]	beta	beta 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	2.88**	[2.59, 3.16]						
Zero-Sum Mindset	-0.17**	[-0.24, -0.11]	-0.22	[-0.31, -0.14]	.05	[.01, .08]	-.24**	
Income	0.00	[-0.00, 0.00]	0.08	[-0.01, 0.17]	.01	[-.01, .02]	.12**	
Education	0.04	[-0.00, 0.09]	0.08	[-0.01, 0.17]	.01	[-.01, .02]	.13**	
								R^2 = .075** 95% CI[.03,.12]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
* indicates $p < .05$. ** indicates $p < .01$.

Table 8

Regression results using personal trust as the criterion

Predictor	b	b 95% CI [LL, UL]	beta	beta 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	4.41**	[4.10, 4.72]						
Zero-Sum Mindset	-0.17**	[-0.24, -0.10]	-0.20	[-0.29, -0.11]	.04	[.01, .07]	-.21**	
Income	0.00**	[0.00, 0.00]	0.14	[0.05, 0.22]	.02	[-.00, .04]	.15**	
Education	0.00	[-0.05, 0.05]	0.00	[-0.08, 0.09]	.00	[-.00, .00]	.07	
								R^2 = .064** 95% CI[.03,.11]

Table 9

Regression results using trust in the justice system as the criterion

Predictor	b	b 95% CI [LL, UL]	beta	beta 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	2.89**	[2.54, 3.23]						
Zero-Sum Mindset	-0.15**	[-0.23, -0.07]	-0.16	[-0.25, -0.07]	.02	[-.00, .05]	-.18**	
Income	0.00**	[0.00, 0.00]	0.17	[0.08, 0.26]	.03	[-.00, .06]	.19**	
Education	0.02	[-0.03, 0.08]	0.04	[-0.05, 0.12]	.00	[-.00, .01]	.10*	
								R^2 = .065** 95% CI[.03,.11]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
* indicates $p < .05$. ** indicates $p < .01$.

Table 10

Regression results using trust in institutional knowledge as the criterion

Predictor	b	b 95% CI [LL, UL]	beta	beta 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	r	Fit
(Intercept)	3.24**	[2.92, 3.55]						
Zero-Sum Mindset	-0.08*	[-0.15, -0.01]	-0.09	[-0.18, -0.01]	.01	[-.01, .02]	-.12**	
Income	0.00	[-0.00, 0.00]	0.04	[-0.05, 0.13]	.00	[-.01, .01]	.09*	
Education	0.09**	[0.03, 0.14]	0.15	[0.06, 0.24]	.02	[-.00, .05]	.17**	
								R^2 = .041** 95% CI[.01,.08]

Table 11

Regression results using trust in government as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	2.23**	[1.92, 2.54]						
Zero-Sum Mindset	-0.07	[-0.14, 0.00]	-0.08	[-0.17, 0.00]	.01	[-.01, .02]	-.11*	
Income	0.00	[-0.00, 0.00]	0.07	[-0.02, 0.16]	.00	[-.01, .02]	.11*	
Education	0.07**	[0.02, 0.12]	0.13	[0.04, 0.22]	.01	[-.01, .04]	.15**	
								R^2 = .036**
								95% CI[.01,.07]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
* indicates *p* < .05. ** indicates *p* < .01.

Table 12

Regression results using trust in business as the criterion

Predictor	*b*	*b* 95% CI [LL, UL]	*beta*	*beta* 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	*r*	Fit
(Intercept)	2.94**	[2.68, 3.19]						
Zero-Sum Mindset	-0.10**	[-0.16, -0.04]	-0.15	[-0.24, -0.06]	.02	[-.00, .05]	-.16**	
Income	0.00*	[0.00, 0.00]	0.11	[0.02, 0.20]	.01	[-.01, .03]	.12**	
Education	-0.01	[-0.05, 0.03]	-0.02	[-0.11, 0.07]	.00	[-.00, .00]	.03	
								R^2 = .036**
								95% CI[.01,.07]

Note. A significant *b*-weight indicates the beta-weight and semi-partial correlation are also significant. *b* represents unstandardized regression weights. *beta* indicates the standardized regression weights. sr^2 represents the semi-partial correlation squared. *r* represents the zero-order correlation. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively.
* indicates *p* < .05. ** indicates *p* < .01.

Study 7: A Longitudinal Trust "Strain Test"

In a review of the psychological foundations of trust, Simpson (Simpson, 2007) suggests that one of the many challenges in studying trust is the difficulty in observing trust in the situations where it is most meaningful, that is, in a "strain test" of trust. A strain test is a situation in which people or group interests are highly interdependent, the fate or welfare of one depends upon the actions of the other, but where a single individual or group's interests may run counter to the actions required for overall welfare.

The onset of the COVID-19 pandemic presented just such a situation. A global pandemic, perhaps more than any other form of public crisis, requires widespread cooperation and sacrifice from citizens and nations in order to be successful (Devine, Gaskell, Jennings, & Stoker, 2020). Building upon data collected in Study 6, six months before the beginning of the pandemic, we revisited this participant sample, collecting repeated measures of trust and zero-sum mindset in March and April of 2020. This data offered a broadly ecologically valid strain test of public trust and its effects on cooperation and enabled us to examine how a zero-sum mindset shapes trust during a crisis when it is most needed.

Hypotheses

Firstly, we hypothesized that a zero-sum mindset at Timepoint 1 (pre-COVID) would predict relatively lower levels of trust when under strain (Timepoints 2 and 3) from the onset of the pandemic. Furthermore, while it is likely that trust and zero-sum mindset have a reciprocal influence on one another, we hypothesized that the effect of zero-sum mindset on trust would be stronger than the effect of trust on zero-sum mindset.

Secondly, we hypothesized that these trust deficits would mediate the relationship between zero-sum mindset and lower commitment to collective cooperation in favour of protecting individual interests during the pandemic.

Method

Participants & Procedure. Participants who completed Study 6 in July 2019 (Timepoint 1) were invited through the Prolific platform to participate in Study 7 in March 2020 (Timepoint 2) during the early onset of the COVID-19 pandemic. Measures were repeated again two weeks later in April 2020 (Timepoint 3). The final dataset for analyses comprised 499 participants representing 1,153 observations across 3 measurement occasions. The survey at Timepoint 2 took approximately 8 minutes to complete and participants were rewarded £1.15 upon completion. The survey at Timepoint 3 took approximately 9 minutes to complete and participants were rewarded £1.35 upon completion.

Measures.

Zero-Sum Mindset. Zero-sum mindset was measured using the same items selected from the *BZSG* used in Study 1.

Self-Reported Trust. Participants repeated the same trust measures used in Study 6 indicated their degree of trust on a scale from "No trust at all" (1) to "A lot of trust" (5). Degree of trust was rated for people in general (most people, strangers), interpersonal relationships (family, friends, neighbours), justice institutions (police, courts), government (local government, federal government), knowledge institutions (science, journalism), and business institutions (local businesses, large companies). The mean of all trust ratings across targets was used as a broad measure of generalized trust ($\alpha = .82$).

Results and Discussion

While we expected to find a reciprocal relationship between trust and zero-sum mindset, with lower trust leading to higher zero-sum mindset and vice versa, our key hypothesis was that zero-sum mindset would more robustly predict trust over time. We built separate multilevel models of change over time for zero-sum mindset and trust, respectively. To evaluate the directionality of the relationship between these two constructs, we compared the effect estimates and overall performance of the models.

Multilevel model of zero-sum mindset over time.
Upon inspection of the participants' individual scatterplots, we determined that within-person change in zero-sum mindset over time was minimal (essentially replicating earlier findings of the stability of zero-sum mindset) and approximately linear. Using the statistical programming language R, we iteratively specified and estimated a longitudinal linear growth curve model for zero-sum mindset with trust operationalized as a time-varying covariate. Our final model allowed each participant to have their own initial level of and rate of change in zero-sum mindset.

The results are presented in Table 13. Table 13 shows two sets of effect estimates. The fixed effects illustrate estimated unit changes in zero-sum mindset per unit change of a given predictor for the average individual in the sample. The second set of parameter estimates in Table 1 are the random effects, the indicators of variability within and between individual participants. In our reporting of these effects, we employ the Raudenbush and Byrk (2002) notation. σ^2 indicates the (upper-level) residual variance estimates found within individuals. τ_{00} represents estimates for inter-individual variances—in this instance, the estimated variation between individual intercepts and the average intercept across all individuals. τ_{11} provides estimates of random slope variance—the estimated variation between individual rates of change in zero-sum mindset and the average rate of change across all individuals. ϱ_{01} represents the estimated correlation between the random intercept and random slope variables.

To test whether differences in starting levels of zero-sum mindset were significant, we specified an initial null (i.e., unconditional means) model. The resulting model estimate for intercept was 2.68 (p < 0.001), which provided the mean level of zero-sum mindset across all participants at all time points and indicated that participants varied significantly in their initial levels of the construct. To evaluate the longitudinal stability of zero-sum mindset, we continued to build an unconditional growth model with time as a predictor of zero-sum mindset with random intercepts and fixed slopes. Time was not a significant predictor of zero-sum mindset. When we allowed individual slopes to vary randomly (see "Unconditional Growth, Random Slopes" model in Table 13), model fit improved modestly but the effect of time was still non-significant. Taken together, the results of these two unconditional growth models therefore suggest that growth rates in zero-sum mindset scores over the three time points did not significantly differ across individuals in the sample. We incorporated mean-level trust as a predictor of zero-sum mindset in our conditional growth model. This model demonstrated that trust was significantly related to zero-sum mindset—measurement occasions with a unit increase in trust also showed an estimated mean decrease in zero-sum mindset by 0.18 units (*p* = 0.001). Our last model gauged the possible interaction between time and trust as a predictor of change in zero-sum mindset; it indicated this interaction was not significant.

Multilevel model of trust over time.
We followed the same model-building procedure for our growth curve model of trust over time—in this instance, zero-sum mindset was examined as the predictor (rather than the outcome) of trust. The results are presented in Table 14. In our initial null model, the estimate for intercept was 2.94, suggesting differences between starting levels of trust between individuals were significant. In our unconditional growth models, across both fixed slopes and random slopes implementations, the additional covariate of time was not a significant predictor of trust.

Indeed, across all of our random slopes models of trust, the variance estimates between individual and average growth rates were consistently close to zero, underscoring the general stability of generalized trust measures. These findings indicated that rates of change in generalized trust did not vary significantly across individuals. However, our conditional growth model showed that zero-sum mindset significantly predicts a very modest mean decrease in trust (–0.04; $p = 0.017$). The addition of zero-sum mindset as a time-varying covariate resulted in a slightly stronger estimate for this effect (–0.07; $p < .001$). The estimated interaction between zero-sum mindset and time, while statistically significant, was close to zero.

Table 13

Multilevel Growth Curve Models of Zero-Sum Mindset

Predictors	Null Model			Unconditional Growth, Fixed Slopes			Unconditional Growth, Random Slopes			Conditional Growth			Time-Varying Conditional Growth		
	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p
(Intercept)	2.68	2.60 – 2.76	**<0.001**	2.70	2.61 – 2.78	**<0.001**	2.70	2.62 – 2.78	**<0.001**	2.69	2.61 – 2.77	**<0.001**	2.69	2.61 – 2.77	**<0.001**
time (weeks)				-0.00	-0.00 – 0.00	0.300	-0.00	-0.00 – 0.00	0.347	-0.00	-0.00 – 0.00	0.365	-0.00	-0.00 – 0.00	0.368
trust										-0.18	-0.29 – -0.07	**0.001**	-0.25	-0.38 – -0.12	**<0.001**
time * trust													0.00	-0.00 – 0.01	0.088
Random Effects															
σ^2	0.28			0.28			0.16			0.16			0.16		
τ_{00}	0.66 PROLIFIC_PID			0.66 PROLIFIC_PID			0.74 PROLIFIC_PID			0.69 PROLIFIC_PID			0.69 PROLIFIC_PID		
τ_{11}							0.00 PROLIFIC_PID.Timepoint			0.00 PROLIFIC_PID.Timepoint			0.00 PROLIFIC_PID.Timepoint		
ϱ_{01}							-0.26			-0.24			-0.23		
ICC	0.71			0.70			0.84			0.83			0.83		
N	503 PROLIFIC_PID			503 PROLIFIC_PID			503 PROLIFIC_PID			499 PROLIFIC_PID			499 PROLIFIC_PID		
Observations	1162			1162			1162			1153			1153		
Marginal R^2 / Conditional R^2	0.000 / 0.705			0.000 / 0.705			0.000 / 0.836			0.011 / 0.829			0.011 / 0.830		
AIC	2730.127			2742.996			2678.690			2641.268			2650.797		
log-Likelihood	-1362.064			-1367.498			-1333.345			-1313.634			-1317.399		

Table 14

Multilevel Growth Curve Models of Trust

Predictors	Null Model			Unconditional Growth, Fixed Slopes			Unconditional Growth, Random Slopes			Conditional Growth			Time-Varying Conditional Growth		
	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p	Estimates	CI	p
(Intercept)	2.94	2.89 – 2.98	**<0.001**	2.93	2.89 – 2.98	**<0.001**	2.93	2.89 – 2.98	**<0.001**	2.93	2.89 – 2.98	**<0.001**	2.94	2.89 – 2.98	**<0.001**
time (weeks)				0.00	-0.00 – 0.00	0.499	0.00	-0.00 – 0.00	0.543	0.00	-0.00 – 0.00	0.595	0.00	-0.00 – 0.00	0.566
zero-sum mindset										-0.04	-0.06 – -0.01	**0.017**	-0.07	-0.11 – -0.04	**<0.001**
time * zero-sum mindset													0.00	0.00 – 0.00	**0.001**
Random Effects															
σ^2	0.06			0.06			0.05			0.05			0.05		
τ_{00}	0.22 PROLIFIC_PID			0.22 PROLIFIC_PID			0.24 PROLIFIC_PID			0.23 PROLIFIC_PID			0.23 PROLIFIC_PID		
τ_{11}							0.00 PROLIFIC_PID.Timepoint			0.00 PROLIFIC_PID.Timepoint			0.00 PROLIFIC_PID.Timepoint		
ϱ_{01}							-0.25			-0.23			-0.19		
ICC	0.79			0.79			0.84			0.83			0.83		
N	499 PROLIFIC_PID			499 PROLIFIC_PID			499 PROLIFIC_PID			499 PROLIFIC_PID			499 PROLIFIC_PID		
Observations	1153			1153			1153			1153			1153		
Marginal R^2 / Conditional R^2	0.000 / 0.793			0.000 / 0.793			0.000 / 0.835			0.004 / 0.831			0.008 / 0.832		
AIC	1107.030			1122.050			1113.532			1116.657			1121.140		
log-Likelihood	-550.515			-557.025			-550.766			-551.329			-552.570		

Indices of fit across models.

In general, our tested growth models of trust demonstrated better fit than their zero-sum mindset counterparts. The Akaike information criteria (AIC) for our final multilevel models of zero-sum mindset were 2,651 and 1,121, respectively. The time-varying conditional growth model for trust showed a log-likelihood of –553, compared to –1,318 for zero-sum mindset. Both models showed quite similar intraclass correlation coefficients (ICCs), which tended to peak at around 0.84. This indicated that a very high percentage of the total variation in zero-sum mindset and trust were attributable to differences among individuals rather than intra-individual change over time. It also illustrated that the average correlation for any pair of responses from

the same individual was very strong. Thus, both models performed similarly in their ability to capture variance in their respective grouping structures. Altogether, these results indicate a better model fit when zero-sum mindset is used as a predictor for changes in trust rather than trust as a predictor for changes in zero-sum mindset.

Behavioural Trust: Trust Game Paradigm

In Studies 8 and 9, we employed a trust game paradigm to test the overarching hypothesis that a stronger zero-sum mindset would also predict less trusting *behaviour*. We also utilize the trust game paradigm to experimentally tease apart the motives and appraisals that might mediate the relationship between zero-sum mindset and trust behaviour.

Trust Game Overview

In this version of the trust game, participants played to win raffle tickets for a £100 cash bonus prize. Each ticket represented an additional entry into the drawing such that winning more tickets meaningfully increases one's chances to win £100. In the first round of the game, participants are initially endowed with 100 tickets and can send any amount, from 0 to 100 tickets to Player 2. In keeping with traditional trust game paradigms, the number of tickets sent is then tripled for Player 2. To include the dynamic of strategic cooperation as in iterated trust games, participants are informed that the game will include two rounds such that each player will have the opportunity to play the role of both trustor and trustee.

As we were primarily interested in assessing participants' basic trust instincts, we assigned all participants to the role of the trustor in Round 1, that is, the player in the game who must make the first decision regarding how many tickets to send to the other player. To facilitate this and to hold constant the trustworthiness of the other player, we use an automated player for Player 2 such that Player 2 always employed a strategy of perfect fairness (sharing multiplied tickets evenly) and reciprocity (in Round 2, Player 2 always sends however many tickets Player 1 chose to send in Round 1). So, for example, if the participant chooses to send 20 tickets in Round 1, then those tickets are tripled so that Player 2 receives 60 tickets. Player 2 splits these tickets evenly, sending back 30 tickets to Player 1. Then in Round 2, Player 2 mirrors Player 1's initial behaviour, sending 20 tickets to Player 1. In the final part of the game, the participant (as Player 1) then gets to make the final decision about how many tickets to send back to Player 2. They can send any amount of their tickets, including zero tickets, back to Player 2. Since this is the final transfer, and there are no future opportunities for cooperation or defection on behalf of the other player, this decision measures the participants' trust*worthiness*, which in this case is also a measure of the participant's commitment to fairness.

Since the game participants play will be objectively the same with the same structural incentives and assurances, differences in participants' behavioural trust will be a function of their own internal motives and biases in judgment. This general game paradigm was used for Studies 8 and 9. Experimental conditions and measures specific to each study are described below.

Study 8

Hypotheses

Our main hypothesis was that a stronger zero-sum mindset will predict lower trust behaviour in the trust game. We also predicted that those with a zero-sum mindset will be less trustworthy themselves, will anticipate lower returns from the other player, will be motivated by winning more tickets than the other player, perhaps even to the neglect of potential gains through cooperation, and will perceive the game as unfair to them despite being designed to be objectively fair.

Method

Participants & Procedure. Five hundred and ninety-nine UK residents completed the study. Of the 599 participants, 534 (89%) identified as white, 30 (5%) as Asian/South Asian, 12 (2%) Black, and 23 (4%) as mixed race or other; Three hundred and thirty-four participants (56%) identified as female; Participants' ages ranged 18-80 years old, $M_{age} = 37.89$, SD = 13.58). Participants were recruited using the Prolific platform. To help correct for the highly liberal skew in the Prolific participant population, recruitment targeted a more balanced representation of liberal and conservative participants using Prolific recruitment settings. The questionnaire was administered online and took about 5 minutes to complete. Participants who failed a simple attention check were asked to return their submission to Prolific and their data was not used for analysis. Participants who completed the survey received a code they could redeem for £0.67 on Prolific.

Measures.

Behavioural Trust. We measured behavioural trust as the number of tickets entrusted to the other player at the outset of the game which ranged from 0 to 100 tickets.

Anticipated Return. After the participant has made their selection for how many tickets to entrust to the other player and just before they see the amount that the other player has returned to them, we ask participants to guess how many tickets they expect the other player will return. We measure the degree to which they anticipate trustworthiness or reciprocity from others as the ratio of the amount they expect to receive back to the number of tickets that represents an even distribution rounding up to the nearest whole ticket. So, a value of 1 would represent an expectation of perfect fairness and reciprocity, values between 0 and 1 represent an expectation of unfairness such that the participant expects that other player will send back less than half of total earnings, and values more than 1 represent an expectation of generosity, that the other player will share more than half of the earnings.

Trustworthiness. In this game design, participants are given the final opportunity to send back tickets, which means they have the chance to exploit the other player's trust by keeping an unfair number of tickets. Given that Player 2 splits tickets evenly in Round 1, the "trustworthy" response would be for the participant to also send back an even distribution of tickets. Since the

absolute number of tickets available at this point in the game is a function of their original trust, we measured trustworthiness as the final ratio of Player 1's tickets (participant) to Player 2's tickets, with more equitable ratios (closer to 1 or less than 1) as more trustworthy and more self-serving ratios (more than 1 and higher) as less trustworthy.

Estimated potential growth. Participants were asked to provide a "quick, rough estimate for how many tickets total you think could possibly be generated by both players" through playing the game. Response options ranged from 0 to 1000 in even 100 ticket increments (0, 100, 200, 300…1000).

Game Motives. Participants rated the degree to which their decisions and strategies in the game were guided by the following motives: "Trying to gain as many tickets as possible", "Trying to earn more tickets than the other player", "For fun/curiosity", "Trying to play 'nice'", "Trying to avoid being exploited (taken advantage of) by the other player." Each of these possible motives was rated on a scale from "Not at all" (1), to "Strongly" (4).

Suspicion of Automated Player. To control for possible suspicion that Player 2's choices were predetermined, at the end of the study we asked participants to rate the degree to which they suspected that Player 2 was an automated player on a scale from Definitely not (1) to Definitely (5).

Results and Discussion

First, we looked at the mean, standard deviations and zero-order correlations of key variables in our analysis (see Table 15).

Table 15

Means, standard deviations, and correlations with confidence intervals (N = 599)|

Variable	M	SD	1	2	3	4	5	6	7
1. Zero-Sum Mindset	2.76	0.98							
2. Trust (number of tickets sent)	44.72	31.10	-.09* [-.17, -.01]						
3. Anticipated Split Ratio	0.99	0.66	-.03 [-.11, .05]	.30** [.22, .37]					
4. Final Score Ratio	1.17	0.52	-.03 [-.11, .05]	.19** [.11, .26]	-.03 [-.11, .05]				
5. Final Score	194.95	84.72	-.12** [-.19, -.04]	.74** [.70, .77]	.15** [.07, .22]	.72** [.68, .76]			
6. Age	37.89	13.58	-.07 [-.15, .01]	-.06 [-.14, .02]	.10* [.02, .17]	-.07 [-.15, .01]	-.08* [-.16, -.00]		
7. Sex (Female = 0; Male =1)	0.44	0.50	.15** [.07, .23]	.17** [.09, .24]	.10* [.02, .17]	.12** [.04, .20]	.14** [.06, .21]	-.06 [-.14, .02]	
8. Education	4.25	1.36	-.06 [-.14, .02]	.05 [-.03, .13]	.04 [-.04, .12]	-.05 [-.13, .03]	-.01 [-.09, .07]	-.01 [-.09, .07]	-.04 [-.12, .04]

Note. M and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Trust. As predicted, we find that a zero-sum mindset is negatively correlated with trust behaviour. In this study, the only demographic variable that also predicted trust behaviour was gender, with men demonstrating higher trust than women, which is in keeping with findings from the broader literature (Chaudhuri & Sbai, 2011). When we use linear regression to control for gender, we find that gender appears to suppress the effect of zero-sum mindset on trust such that the relationship between zero-sum mindset and trust becomes slightly stronger and more significant when controlling for gender (*beta = .12, p = .005*).

Trustworthiness. Contrary to our expectation, we did not find a significant relationship between zero-sum mindset and the final proportion of tickets sent back to the other player in the final round (*b = -.02, p =.45*). However, we also note that many participants mentioned experiencing some trouble calculating the right number of tickets to send back to Player 2 in order to achieve their desired ratio. Study 9 addresses this by providing participants a table of possible outcomes depending on how many tickets they choose to send back.

Anticipated Return. While those with a stronger zero-sum mindset do expect to receive a slightly lower number of tickets returned from the other player (*b = -5.13, p = .04*), this effect appears to be a function of the lower initial number of tickets that the participant sent themselves. Since the other player in the game has more tickets available to split if the participant sent more tickets initially, we calculated anticipated return as a ratio of their expectation to the amount that would represent an even split of the total tickets available to split such that if the participant sent 10 or 100 tickets, an expectation of an even split of the multiplied tickets would be 15 or 150 respectively, both with a ratio of 1. We find, somewhat

surprisingly, no relationship between zero-sum mindset and the anticipation of a lower ratio of return (b = -.02, p = .45). But if those with a zero-sum mindset are no more or less predisposed to expect lower returns from the other player, why would they not send more tickets? To answer this question, we examine other possible motives measured in post-game survey questions.

Motives. Means, standard deviations, and zero-order correlations of reported game motives are reported in Table 16. As hypothesized, we find that those with a zero-sum mindset report being primarily motivated to "beat" the other player, seeing them as a rival rather than as a potential partner in earning tickets. This may help explain why participants with a stronger zero-sum mindset may have been reluctant to send more tickets to the other player, *even if they expected the other partner to cooperate.* It is also interesting to note that while we observe a positive correlation with zero-sum mindset and the motivation to earn as many tickets as possible, in this study we find that those with a zero-sum mindset actually end up with fewer tickets (b = 9.9, p =.004). Illustrating once again how a preoccupation with short-term dominance can ultimately undermine gains.

Table 16

Means, standard deviations, and game motivation correlations with confidence intervals

Variable	*M*	*SD*	1	2	3	4
1. Zero-Sum Mindset	2.76	0.98				
2. Trying to gain as many tickets as possible	1.54	1.02	.09* [.01, .17]			
3. Trying to earn more tickets than the other player	0.97	1.08	.17*** [.09, .25]	.46** [.40, .52]		
4. For fun/curiosity	1.99	0.88	-.12** [-.19, -.04]	-.03 [-.11, .05]	.05 [-.03, .13]	
5. Trying to play "nice"	1.92	1.02	-.13** [-.21, -.05]	-.38*** [-.44, -.30]	-.43*** [-.50, -.37]	.15*** [.07, .23]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates *p* < .05. ** indicates *p* < .01, *** indicates *p* < .001.

Suspicion of an Automated Player. After playing the game, 88% of participants reported some degree of uncertainty as to whether or not they were playing the game with another participant in real time or with an automated player. This uncertainty appears to have led most participants to operate under the assumption that they were interacting with another participant in real time. Most importantly, we observed no relationship between participants' suspicion that the other player might be automated and trust behaviour in the game (p = .96).

Exploratory hypothesis. We also explored the hypothesis that because those with a zero-sum mindset tend to see resources as fixed, they might also *systematically* neglect or underestimate the

potential benefits of cooperation and that this may then lead to less trusting behaviour. One way we explored this possibility was by asking participants after playing the game to quickly estimate without doing any calculations how many tickets they assumed could have been generated (total between both players) through paying the game. Initial pilot study results ($N = 450$) suggested that those with a zero-sum mindset systematically underestimated the potential growth (controlling for education, $b = -24$, $p = .004$), but results in this study showed a weaker effect (also controlling for education, $b = -21$, $p = .08$). However, it stands to reason that one's estimation of the potential growth *before* rather than *after* playing the game will be a more meaningful predictor of behaviour. Therefore, a better measure would assess participant estimation immediately after reading how the game works but before play begins. While traditional economic models might assume perfect rationality on behalf of players and treat incorrect assumptions about potential gains in the game as mere noise, variability in these estimations appears to systematically predict behaviour. Therefore, understanding the psychological mechanisms that predict systematic neglect of potential growth may also help us account for differences in trust behaviour when structures and incentives are otherwise objectively the same. We investigate this potential mechanism in Study 9.

Study 9

In Study 9, we sought to replicate the relationship between zero-sum mindset and trusting behaviour and to test the hypothesis that those with a zero-sum mindset systematically *underestimate the potential benefits of cooperation* and that this underestimation leads to less trusting behaviour.

To investigate whether perceptions of potential growth might mediate the relationship between zero-sum mindset and trusting behaviour, in Study 9 we randomly assigned participants to one of three conditions: In the first condition, participants were asked to quickly estimate without doing any detailed calculations how many tickets they think could be generated by both players before beginning the game (Pre-Game Estimate Condition). In the second condition, participants were told explicitly the maximum number of tickets that could be generated before playing the game by describing a strategy of perfect coordination and trust (Pre-Game Information Condition). In the third condition, participants were asked to estimate possible growth after the game just as in previous studies (Post-Game Information Condition). In this way, we can observe separately the effects of estimations of potential growth, explicit knowledge of potential growth, and the effect of game play itself on the perception of potential growth. And finally, we can test whether these perceptions of potential growth mediate or moderate the relationship between zero-sum mindset and trust behaviour.

Main Hypotheses
We expect to find a main effect of zero-sum mindset on trust behaviour across conditions such that stronger zero-sum mindset (measured both several weeks before and immediately after playing the game) will predict lower trust behaviour when controlling for sex, thereby replicating the main hypothesis from Study 8. We also expected a replication of the finding that those with higher zero-sum mindset will be more likely to see the game as "unfair" to them and will be more motivated to win more tickets than the other player. In addition to expected replications,

we hypothesized that those with stronger zero-sum mindsets will systematically underestimate potential growth, and that this lower estimation will lead to lower trust behaviour.

Exploratory Hypotheses

By comparing pre-game and post-game estimate conditions, we will test whether the experience of playing the game alters one's estimations of the potential growth. We will also test the hypothesis that focusing participant attention on potential gains or receiving explicit information about possible gains before decision-making will mitigate trust deficits for those with stronger zero-sum mindsets. Lastly, we will explore whether providing a clearer guide of the distribution of final ticket outcomes will reveal differences in "trustworthiness" for those with a zero-sum mindset.

Method

Participants. Four hundred and nineteen U.S. residents completed the study, of which 323 (77%) identified as white, 37 (9%) Asian/South Asian, 25 (6%) as Latinx/Hispanic, 21 (5%) as black/African American, 4 (1%) as Native American, and 9 (2%) as other or preferred not to respond; 58% female; Ages ranged 18-77, M_{age} = 36.67, SD = 12.75). Participants were recruited using the Prolific platform in two stages. First, a large ($N > 1500$) representative sample was collected which measured baseline zero-sum mindset and demographic variables. Several days later participants from this sample were invited to participate in the study so that we could test the stability of zero-sum mindset on trust behaviour. Participation took place online and took about 10 minutes to complete. Since the attention check was placed later in this survey, all participants were paid for their time, but the data of those who failed the attention check was not used for analysis. Participants who completed the survey received a code they could redeem for £1.13 on Prolific.

Procedure. After reading about how the game works, participants were randomly presented with one of the three conditions described above. Next all participants played the trust game, followed by additional questions including the post-game estimation for those assigned to that condition as well as their motives and perceptions when playing the game. Lastly, participants were debriefed and reminded of the specific date of the raffle drawing for their chance to win £100. Every player who completed the study was entered into the raffle at least once. For every ticket won in the game, a participant's anonymous ID was added to the pool from which a winner was randomly selected and paid a £100 cash bonus through the Prolific platform.

Measures

Zero-Sum Mindset. We employed the 7-item measure of zero-sum mindset used in Study 2, which includes reverse-key items to help control for acquiescence.

Trust. Just as in Study 8, we measured behavioural trust as the number of tickets entrusted to the other player at the outset of the game which ranged from 0 to 100 tickets.

Trustworthiness. Also, as in Study 8, participants are given the final opportunity to send back tickets, which means they have the chance to take advantage of the other player by keeping all of the tickets sent by Player 2 in the second round of the game or to share some portion of the tickets entrusted. Given the feedback we received that many participants struggled to calculate how many tickets to send in order to achieve a certain final distribution, we provided participants with a guide, generated from their current ticket totals, which showed them the number of tickets they would need to send in order to achieve various distribution outcomes on a spectrum from giving all tickets to the other player, to keeping all tickets for oneself. However, this was only a guide. Just as in Study 8, participants can send any amount and trustworthiness is measures as the final ratio of Player 1's tickets (participant) to Player 2's tickets, with more equitable or generous ratios (closer to 1 or less than 1) as more trustworthy and more self-serving ratios (more than 1 and higher) as less trustworthy.

Estimated potential growth. Participants were asked to provide a "quick, rough estimate for how many tickets total you think could possibly be generated by both players" through playing the game. Response options ranged from 0 to 1000 in even 100 ticket increments (0, 100, 200, 300…1000).

Game Motives. Participants rated the degree to which their decisions and strategies in the game were guided by the following motives: "Trying to gain as many tickets as possible", "Trying to earn more tickets than the other player", "For fun/curiosity," "Trying to play 'nice'," "Trying to avoid being exploited (taken advantage of) by the other player." Each of these possible motives was rated on a scale from "Not at all" (1) to "Strongly" (4).

Results and Discussion

Trust. First, we use linear regression to replicate the main findings from Study 8. We replicated the hypothesis that stronger zero-sum mindset will predict lower trust behaviour across conditions when controlling for sex. We further test the stability of the effect by repeating this analysis with the measure of zero-sum mindset collected several days before the participant played the game. As predicted, we continue to find the main effect of stronger zero-sum mindset predicting lower trust behaviour, thereby replicating the main hypothesis from Study 8. This effect appears stronger for the contemporaneous measure of zero-sum mindset than for the measure taken 3 days prior, as should be expected given that the contemporaneous measure captures both trait (stable over time) and state (current moment) zero-sum thinking.

Trustworthiness. When we remove the need for participants to calculate how their final transfer of tickets will determine the final distribution of tickets by providing them with an automatically generated guide of the possible outcomes, we find that those with stronger zero-sum mindsets are more likely to exploit this final transfer to their advantage (*beta* = .13, *p* = .008), giving themselves a higher ratio of tickets despite the other player having shared tickets evenly in the first round. However, this was only the case for the post-game measure of zero-sum mindset. Zero-sum mindset measured three days prior did not predict trustworthiness. Further exploratory analysis reveals that participants who demonstrated lower trustworthiness, that is by giving themselves a large share of the tickets in the final decision were also more likely to show

increases in their zero-sum mindset (*beta* = .19, *p* <.001). This suggests that participants facing the final choice (a zero-sum decision embedded in a broader non-zero-sum game) who exploited this power may have justified their behaviour by more strongly embracing the notion that this is just how the world works. Future research should test this hypothesis more directly.

Perception of Potential Gains. We hypothesized that those with stronger zero-sum mindsets will systematically underestimate potential growth, and that this lower estimation will lead to lower trust behaviour. First, we tested the hypothesized relationships between zero-sum mindset and the perception of possible growth, and between the perception of possible growth and trust behaviour. As predicted, we find a main effect of zero-sum mindset such that for every unit increase in zero-sum mindset (on a scale from 1-7) we observe 23.12 fewer tickets estimated (See Table 18). We also observed the expected effect of condition such that participants in the explicit information condition recognize more potential growth than those in the pre- and post-game estimation conditions. While pre- and post-game estimates did not significantly differ, those who estimated growth *before* playing the game demonstrated higher trust (See Table 17). In other words, playing the game does not appear to significantly alter estimations of potential gains, but bringing attention to possible gains before decision-making does appear to increase trust behaviour. This suggests two distinct ways in which perception of possible growth can influence trust behaviour: through mere salience (as in the conditions of calling attention to potential gains before the game), and through systematic perceptual bias (as we observe in the effect of zero-sum mindset across all conditions). Interestingly, we also observe the effect of zero-sum mindset on perception of possible gains in the *explicit information* condition. Suggesting that those with stronger zero-sum mindsets may have distrusted even the given explanation of how to maximize gains through trust coordination (See Figure 5).

Table 17

Descriptive Statistics of Trust by Condition

CONDITION	Mean	SD	N
Pre-Game Estimation	62.939	32.518	148
Pre-Game Information	67.373	35.022	150
Post-Game Estimation	51.344	32.260	151

Table 18

Regression results using perception of possible gain as the criterion

Predictor	b	b 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	Fit
(Intercept) Pre-game Estimate Condition	600.01**	[534.54, 665.48]			
Zero-Sum Mindset	-23.12*	[-41.31, -4.93]	.01	[-.01, .03]	
Pre-game Information Condition	294.01**	[238.62, 349.39]	.19	[.13, .26]	
Post-game Estimation Condition	-15.91	[-71.01, 39.19]	.00	[-.00, .00]	
					R^2 = .274** 95% CI[.20,.34]

Note. A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. sr^2 represents the semi-partial correlation squared. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. * indicates p < .05. ** indicates p < .01.

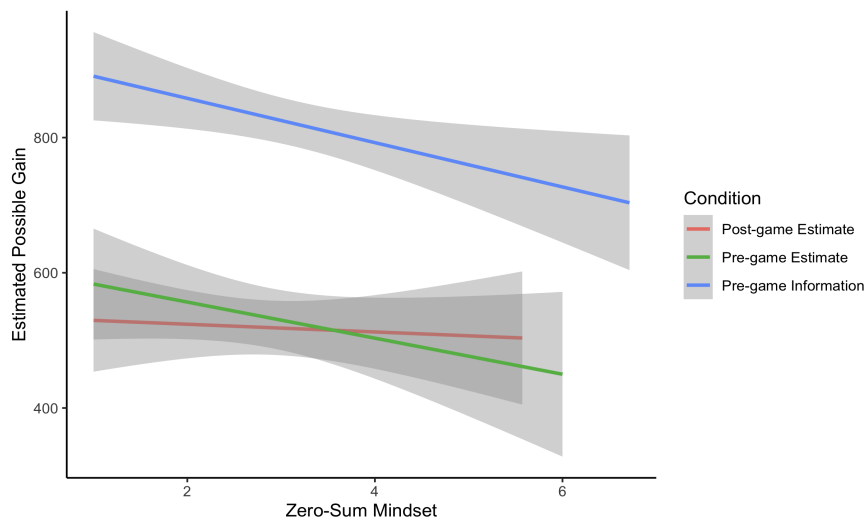Figure 5: The Effect of Zero-Sum Mindset on Estimated Possible Gains by Condition

Table 19

Regression results using trust behavior as the criterion

Predictor	b	b 95% CI [LL, UL]	sr^2	sr^2 95% CI [LL, UL]	Fit	Difference
(Intercept) – Pre-Game Estimate	47.44**	[38.43, 56.44]				
Perceived gain	0.03**	[0.01, 0.04]	.04	[.00, .07]		
Pre-Game Information Condition	-3.51	[-12.14, 5.13]	.00	[-.01, .01]		
Post-Game Estimate Condition	-11.86**	[-19.57, -4.15]	.02	[-.01, .05]		
					R^2 = .079** 95% CI[.03,.13]	

Note. A significant *b*-weight indicates the semi-partial correlation is also significant. *b* represents unstandardized regression weights. sr^2 represents the semi-partial correlation squared. *LL* and *UL* indicate the lower and upper limits of a confidence interval, respectively. * indicates p < .05. ** indicates p < .01.

Figure 6: The Effect of Estimated Gain on Trust
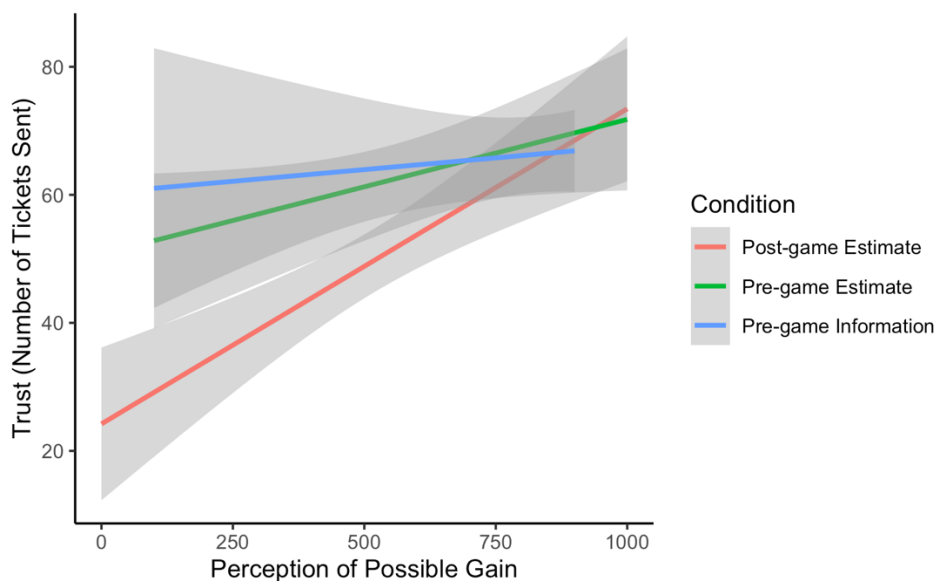
Mediation Analysis. Next, we tested whether perception of possible gain mediates the relationship between zero-sum mindset (measured several days earlier) and trust behaviour when controlling for sex and condition. We find a small, but significant indirect effect suggesting that perception of possible growth partially mediates the relationship between zero-sum mindset and trust behaviour. However, other potential mechanisms, such as perception of rivalry instead of partnership, may account for more of this variance in trust behaviour. Future research should investigate other such possible mechanisms. See results in Table 20.

Table 20

Mediation Analysis

Parameter estimates

Direct effects

			Estimate	Std. Error	z–value	p	95% Confidence Interval Lower	Upper
zsm_mean_t1	→	r1_p1_transfer	−2.619	1.474	−1.777	0.076	−5.507	0.270

Note. Delta method standard errors, normal theory confidence intervals, ML estimator.

Indirect effects

					Estimate	Std. Error	z–value	p	95% Confidence Interval Lower	Upper
zsm_mean_t1	→	gain_possible	→	r1_p1_transfer	−0.926	0.367	−2.522	0.012	−1.645	−0.206

Note. Delta method standard errors, normal theory confidence intervals, ML estimator.

Total effects

			Estimate	Std. Error	z–value	p	95% Confidence Interval Lower	Upper
zsm_mean_t1	→	r1_p1_transfer	−3.544	1.482	−2.391	0.017	−6.449	−0.639

Note. Delta method standard errors, normal theory confidence intervals, ML estimator.

Moderation by Condition. Finally, we tested the hypothesis that correcting the systematic underestimation of possible gains will help mitigate trust deficits for those with stronger zero-sum mindsets. While the results trend in the hypothesized direction (as visualized in Figure 7) such that the slope relating zero-sum mindset to trust appears flatter in the explicit information condition, the interaction between zero-sum mindset and condition did not achieve significance, with all interaction terms' 95% confidence intervals containing zero (all *p's > .05*). So, while we do observe main effects of zero-sum mindset and condition on trust behaviour such that pre-game estimation and information conditions predict higher trust and zero-sum mindset predicts lower trust, the informational manipulation condition did not sufficiently alter trust behaviour specifically for those with a zero-sum mindset. This may be in part because, as we observed earlier, those with a zero-sum mindset systematically underestimate potential growth even in the explicit information condition.

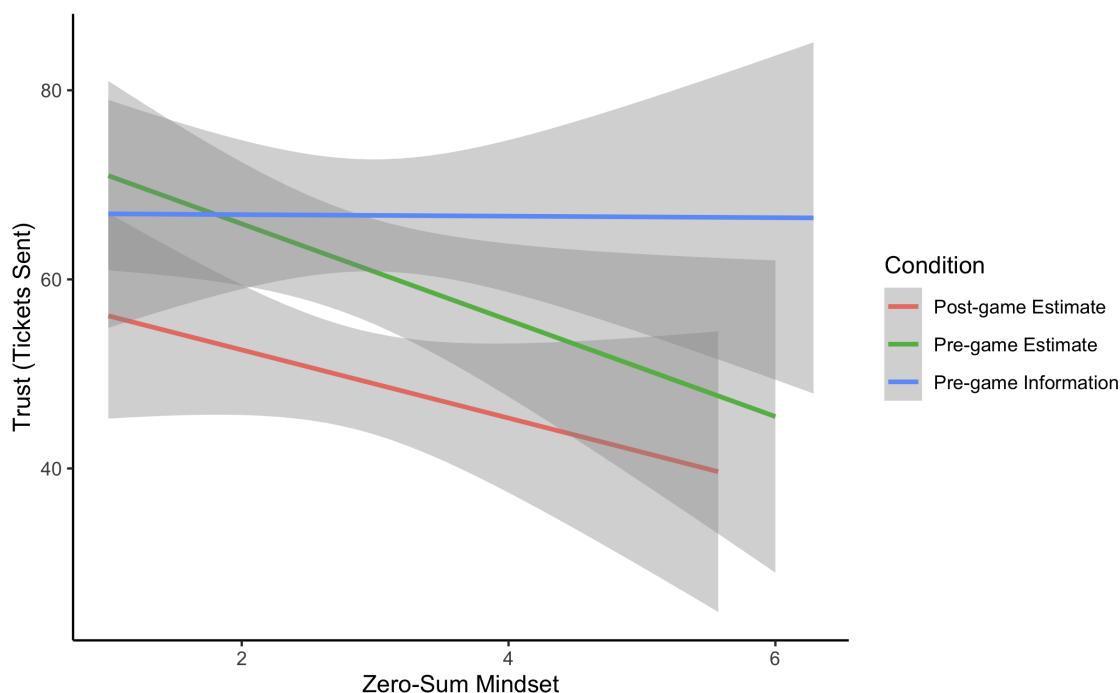Figure 7: The Effect of Zero-Sum Mindset on Trust by Condition

Figure Notes: Gray area = 95% CI

Conclusion

Altogether the results from this investigation indicate that a zero-sum mindset undermines social and economic flourishing by eroding the trust and cooperation upon which a thriving society is built. Despite the many apparent benefits and essential functions of trust and cooperation, this research demonstrates that an implicit view of life as zero-sum can fundamentally alter one's perceptions of social relationships, increasing one's basic perception of hostility and preoccupation with dominance, and thereby increasing one's willingness to use aggressive, anti-cooperative strategies. Furthermore, these results show how a zero-sum mindset erodes the trust needed to foster economic growth in times of stability as well the trust needed to weather times of crisis such as the COVID-19 pandemic.

Our research suggests that zero-sum mindset impairs trust in at least two ways: by systematically leading individuals to be blind to the potential benefits of trust and cooperation, and by promoting an interpretation of others as potential rivals and threats rather than potential partners and collaborators. Solving humanity's most urgent problems, such as climate change, poverty, prejudice, war, and disease, will require new levels of interpersonal, intergroup and international cooperation—cooperation easily undermined by zero-sum mindset. Future research should continue to investigate the origins of zero-sum mindset, and how to foster a view of the world that can engender the future we wish to inhabit.

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Appendix

Measuring Zero-Sum Mindset by adapting the *BZSG* scale

Różycka-Tran, Boski, & Wojciszke (2015) first developed a measure of "Belief in Life as a Zero-Sum Game" (BZSG), which they employed in a 37-nation study that demonstrated how this belief can function as a "social axiom." The authors describe the BZSG as a measurement of the conviction that "success, especially economic success, is possible only at the expense of other people's failures." Accordingly, 3 out of 8 of the BZSG scale items pertain specifically to the economic domain (see items indicated by asterisk below).

Original scale (BZSG)
Likert-scale items, agreement rated from 1 (*strongly disagree*) to 7 (*strongly agree*)

1. Successes of some people are usually failures of others
2. If someone gets richer it means that someone else gets poorer *
3. Life is so devised that when somebody gains, others have to lose
4. In most situations interests of different people are inconsistent
5. Life is like a tennis game—a person wins only when others lose
6. When some people are getting poorer it means that other people are getting richer *
7. When someone does much for others, he or she loses
8. The wealth of a few is acquired at the expense of many *

economic-domain items

However, with an aim to investigate how a generalized view of the world as zero-sum (that is without reference to any particular domain) might shape recursive processes across a broad range of domains,[8] we wondered whether these items might represent related, but distinct dimensions of zero-sum thinking. In a sample of 821 participants, we found a large difference between the mean-levels of agreement on these generalized zero-sum belief items and the economically worded items such that economic domain zero-sum beliefs were significantly larger than generalized zero-sum beliefs in a paired samples *t*-test ($t = 23.8$, $p < .0001$, Cohen's $d = .83$). Confirmatory factor analysis (pre-registered) demonstrated that the two-factor model separating economically worded items and general zero-sum mindset items into separate dimensions achieved a significantly better model fit than the single factor model ($\Delta\chi^2 = 850.44$, $p < .0001$), with the two-dimensional model achieving acceptable model fit indices ($\chi^2 = 87.63$, $p < .0001$, Comparative Fit Index (CFI) = 0.983, Root Mean Square Error of Approximation (RMSEA) = 0.066) and the single dimension model showing poor model fit ($\chi^2 = 938.067$, $p < .0001$, CFI) = 0.775, RMSEA = 0.236) following the criterion suggested by Hu and Bentler (1999). This suggests that the 8-item BZSG may be better described as a two-factor measure of 1) economic zero-sum beliefs (items 2,6 and 8 from the original BZSG) and 2) generalized zero-sum beliefs (items 1,3,4,5 and 7 from the original BZSG), that latter of which we employ as our measure of zero-sum mindset.

The initial adaptation of the scale also sought to differentiate between zero-sum beliefs about the relationship between individuals and groups. The adapted items are listed below.

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[8] While the concepts of "social axiom" and "mindset" are closely related, with both referring to generalized and often unquestioned beliefs about how the world works, they differ in their focus and modality. Social axioms aim to describe the fundamental beliefs that shape differences across cultures, while "mindsets" describe the way generalized beliefs function in recursive processes.

Modified scale

Items adapted to measure zero-sum beliefs about individual and group relationships:

Likert-scale items, agreement rated from 1 (*strongly disagree*) to 7 (*strongly agree*)

1.   The success of one person is usually the failure of another person
2.   Life is such that when one person gains, another person has to lose
3.   In most situations, interests of different people are incompatible
4.   When someone does much for others, he or she loses
5.   Life is like a tennis game -- A person wins only when another loses

Adaptation to measure zero-sum beliefs about group relationships:

1.   The success of one group is usually the failure of another group
2.   Life is such that when one group gains, another group has to lose
3.   In most situations, interests of different groups are incompatible
4.   When one group does much for others, that group loses
5.   Life is like a tennis game -- A group wins only when another loses

Adding Reverse-key Items

Finally, to help reduce the scale's vulnerability to acquiescent response style (see Soto, John, Gosling, & Potter, 2008), reverse-key items were added to the scale.

Final Measure of Zero-Sum Mindset

1. The success of one person is usually the failure of another person.
2. Life is such that when one person gains, someone else has to lose.
3. When someone does much for others, they lose.
4. In most situations, different people's interests are incompatible.
5. When one person is winning, it does <u>not</u> mean that someone else is losing. (R)
6. Life is like a tennis game--A person wins only when another person loses.
7. One person's success is <u>not</u> another person's failure. (R)

(R) = reverse-key items
Reliability Statistics: McDonald's ω = .863, Cronbach's α = .855 (*N* = 499)