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Research Article

Ambiguous COVID-19 Messaging Increases Unsafe Socializing Intentions

Vincent Hopkins*, Mark Pickup†, J. Scott Matthews‡

Abstract: Before and during the vaccine roll out, governments reported surging COVID-19 cases due to unsafe socializing among younger individuals. Officials continue to search for effective ways to encourage safe socializing behaviour within this demographic. However, a key challenge is that public health advice is necessarily nuanced and complex, which can create ambiguity. Appropriate behaviour depends on specific circumstances and public messaging cannot detail every situation. When people confront ambiguity in expert guidance, they may engage in motivated reasoning—that is, people's underlying motivations may influence how they process information and make decisions. In a pre-registered experiment, we look at the effect of ambiguous public health messaging on people's inferences regarding the behaviours the government expects them to avoid and intentions to engage in unsafe socializing. We find no evidence of an effect on inferences—that is, people who receive an ambiguous message about COVID-19 make inferences about correct behaviour that are similar to the inferences of those who receive no message. However, we find ambiguous messaging increases unsafe socializing intentions, especially among people aged 18-39 who socialized before the pandemic. Our findings underscore the need for unambiguous communications during public health crises.

Keywords: COVID-19; ambiguity; motivated reasoning; communication

Supplements: Open data, Open materials, Preregistration

Unsafe socializing—such as attending house parties, visiting nightclubs, and sharing drinks or food—has been a major contributor to the spread of coronavirus, particularly among young people. A key challenge is that public health recommendations are necessarily complex and nuanced. This often renders them ambiguous. By ambiguous, we mean that messaging is open to more than one interpretation (cf., Moynihan 2006, Kopko, et al., 2011).[1] Appropriate behaviours depend on specific circumstances, and governments cannot detail every situation. This leaves it up to the individual to infer the correct behaviour in many day-to-day circumstances. Messaging may also vary across different levels of government (state/provincial, national/federal) and international organizations (e.g., World Health Organization). This can lead to contradictions in messaging, apparent or real, which further increase ambiguity.

From a behavioural science perspective, ambiguity is especially problematic because of the potential for *directional motivated reasoning*. Directional motivated reasoning occurs when people's underlying attitudes influence how they process information and make decisions (Chaiken et al. 1989; Kunda 1990; Lodge & Taber, 2013; Taber & Lodge, 2006). In the present context, we theorize people who were highly social before the pandemic may manifest directional motivated reasoning via disconfirmation bias—that is, they may counter-argue against public health restrictions to justify socializing during the pandemic. Ambiguity creates 'wiggle room', allowing people to interpret government recommendations in ways consistent with relevant underlying preferences. For example, a 20-year-old eager to resume normal life may interpret nuanced messaging about unsafe socializing—

*University of Saskatchewan, †Simon Fraser University, ‡Memorial University
Address correspondence to Vincent Hopkins at vince.hopkins@usask.ca

such as whether it is advisable to visit a friend's house—in such a way that they come to believe certain behaviours are permissible when, in fact, they are not.

In this paper, we present a pre-registered experiment looking at the effect of ambiguous messaging on inferences about appropriate socializing behaviour and intentions to engage in unsafe socializing. By inference, we mean the use of reasoning to solve problems of incomplete information (Jaynes, 2003). In the context of the study, we examine the inferences that citizens make regarding the range of behaviours that public health authorities expect them to avoid. We also examine people's intentions to behave in ways that run counter to public health guidance. Contrary to our expectations, we find no evidence of an effect on inferences: that is, participants who receive an ambiguous message about COVID-19 make inferences regarding appropriate socializing behaviour that are similar to those made by participants who receive no such message. However, and consistent with our expectations, we find that ambiguous messaging increases unsafe socializing intentions among highly social people aged 18-39.

Our study considers directional motivated reasoning in a context that is different from other studies of public administration and political science, which often focus on evaluations of government performance (e.g. Deslatte, 2019; Damgaard & Neilsen 2020; Lerusse & Van de Walle 2022) or on partisanship and partisan cues (e.g. Druckman, Peterson and Slothuus, 2013; Kahan et al. 2017; Sylvester 2021). Here, we focus on non-partisan information in a study of attitudes involving perhaps the most salient societal issue in decades. Our survey experiment was conducted in November, 2020. Our sample comes from a single subnational jurisdiction (British Columbia, Canada), ensuring all participants entered the study having been exposed to similar messaging from a single public health authority. We also 'oversampled' people aged 18-39—the demographic responsible for most new COVID-19 cases at the time of our study—and conduct split-sample tests between those aged 18-39 and 40 and over.

Ambiguity and Motivated Reasoning

As Taber and Lodge (2006) write, 'all reasoning is motivated' (150). Following Chaiken et al. (1989) and Kunda (1990), most accounts in the social and behavioural sciences suggest people process information guided by two competing motivations. On one hand, people do not wish to be wrong, which leads them to accept information they believe will lead to the correct inference (Bolsen et al., 2014). This is an 'accuracy' motivation. However, when information is inconvenient—e.g. by being inconsistent with preferred behaviours—people may accept information consistent with those preferences and reject/ignore inconsistent information (Lodge & Taber, 2013; Taber & Lodge, 2006). This is a 'directional' motivation.

Directional motivated reasoning occurs when people's underlying preferences influence how they process information and make decisions. Lodge and Taber (2013, p. 74) suggest it reflects people's automatic, affective response to new information, which leads to predictable biases in attitudes and behaviour. For example, someone who wants to frequent nightclubs during the pandemic might uncritically accept information about the low risks of coronavirus transmission at such venues. This is an example of directional motivated reasoning leading to *confirmation bias*—the individual processes information not to better understand the issue but to support a desired conclusion (Lodge & Taber, 2013). That same individual might also be more critical of and actively counter-argue information suggesting nightclubs are an important vector of transmission. This is an example of *disconfirmation bias*—processing information to oppose an undesirable conclusion (Deslatte, 2019; Kunda, 1990; Lodge & Taber, 2013; Lord et al., 1979).[2]

Directional motivated reasoning is a powerful influence on human behaviour, but it has limits. Kunda (1990) suggests people engage in directional motivated reasoning to the extent they can justify it to themselves—also called a 'reality constraint.' Continuing with the example in the previous paragraph, an avid nightclub-goer who wishes to discount information about nightclub transmission may find it harder to do so after a recent outbreak directly linked to a nightclub is widely reported in the news. Redlawsk et al. (2010) show perceivers eventually hit an affective 'tipping point,' after which directionally inconsistent information reduces bias in judgement.

A growing body of evidence suggests low ambiguity is a reality constraint (Molden & Higgins, 2012, p. 398).[3] Low ambiguity refers to a choice environment in which information reasonably permits only a single interpretation. As ambiguity increases, so does the potential for directional motivated reasoning. In a well-cited

study, Dunning et al. (1989) present people with numerical uncertainty, such as a range in the estimated number of sexual assaults that concealed handguns might prevent over the following year. They then ask people to estimate whether some values in the range are 'more likely' than others. The authors find that people who support gun control estimate a lower number than those who oppose it. The authors conclude that people's prior beliefs on the issue lead them to '[interpret] the uncertainty information in a way that allows them to "see what they want to see."' Depictions of uncertainty can also be non-numeric, which may leave even more room for interpretation and increase the effect of ambiguity. Consistent with this conjecture are the results of Kopko et al.'s (2011) investigation of the role of partisan motivations in acceptance of ballot challenges during election recounts. In an experimental study, the authors find that ballot counters were more likely to accept ballot challenges from co-partisan candidates, though only when the ballot counting rules—which were articulated to participants verbally—were relatively ambiguous (p. 284). One possible mechanism through which ambiguity might encourage directional motivated reasoning is disconfirmation bias: that is, by multiplying the possible interpretations of relevant information, ambiguity may facilitate the counter-arguing that people engage in to oppose directionally inconsistent information.

The potential for directional motivated reasoning presents a serious challenge during COVID-19 (Sylvester, 2021). Until mass vaccination of recent variants is reached, the most effective tool to suppress the spread of the virus is widespread behaviour change. This, in part, is why researchers describe COVID-19 as a behavioural problem as well as a medical one (Van Bavel et al., 2020). However, media reports suggest ambiguities in government messaging are common worldwide—including in the US (Dosani & Sanya and Chai Dingari, 2020), the UK (Perraudin, 2020), and Canada (Kester, 2020), among others. These ambiguities are concerning given uneven compliance with public health guidance, especially among young adults (e.g. Perraudin 2020, Whiteside, 2020, The Canadian Press, 2020). Early in the pandemic, public health guidance called for sustained periods of social isolation. Research suggests isolation may have been especially difficult for young people, who are more likely than older individuals to experience a decrease in mood and emotional state due to 'fear of missing out' ('FOMO') (Przybylski et al. 2013). Indeed, evidence from the first year of the pandemic suggests that young adults were more likely to feel lonely (Teater et al 2021), report unsafe socializing (Forsyth 2022), and contribute to 'super spreader' events (Lau et al. 2020), and were also less informed than others about COVID-19 (Druckman et al. 2021). Younger people may have had stronger motivations to justify unsafe socializing than older individuals, leading them to counter-argue public health guidance and engage in directional motivated reasoning.

This reasoning is in line with research in behavioural public administration on the biases and heuristics that shape citizen evaluations of government and of public services (*inter alia* Andersen and Hjortskov 2015, Baekgaard 2017, Barrows et al. 2016, Marvel 2016, Olsen 2015, 2017, Feitsma & Whitehead 2022, Ewert 2020, Ewert et al 2021).[4] Motivated reasoning has been especially important to the development of behavioural public administration (Grimmelikhuijsen et al 2017). Instead of making an objective evaluation, the evidence suggests citizens may think about and judge government services based on personal biases and preferences. For example, Baekgaard and Serritzlew (2016) use survey experiments to show that citizens systematically interpret information about government performance in biased ways—even when the information is presented unambiguously. Petersen et al. (2019) use a survey experiment to show high-school teachers are more likely to accept performance information when their organization is doing well rather than poorly. Scholars have found evidence of motivated reasoning when citizens encounter information about immigration (Strömback et al 2021) and refugee programs (Lind et al 2022), health care policy (James et al 2017), and sustainability (Deslatte 2019). Looking at COVID-19 beliefs, Sylvester (2021) and Pennycook et al (2021) find limited evidence that cognitive sophistication drives motivated reasoning.[5] However, the potential for ambiguous messaging to bring about directional motivated reasoning remains unexplored. Specifically, we expect that citizens—especially young adults—who want to socialize may exhibit directional motivated reasoning when they encounter ambiguous messaging from government about COVID-19. We believe this is worth investigating because it can help us understand why people might have different reactions to government messaging and how to better design those messages for future campaigns.

Hypotheses

We hypothesize that ambiguous messaging might encourage directional motivated reasoning among people who wish to engage in unsafe socializing. We focus on people's inferences about, and intentions to engage in, unsafe socializing. Specifically, we look at whether people know to avoid unsafe socializing behaviours, such as attending house parties and sharing snacks or drinks. By intentions, we mean whether people plan to engage in those behaviours during the pandemic. We further surmise the effect of ambiguity is strongest among younger individuals, for whom socializing is especially important. In this sense, we expect younger individuals who engaged in highly social behaviours before the pandemic will have a larger stake or interest in perceiving public health guidance in a manner consistent with their intentions. This, in turn, should increase their likelihood of motivated reasoning regarding unsafe socializing.

This leads to three hypotheses:

(H1) The inferences about, and intentions to engage in, unsafe socializing of people who receive an ambiguous message will be less in line with public health guidelines, relative to people in the control condition;

(H2) The effect of an ambiguous message on inferences about and intentions to engage in unsafe socializing (H1) will be strongest amongst those who regularly engaged in the same social behaviours prior to the pandemic[6]; and,

(H3) The effect of an ambiguous message on inferences about and intentions to engage in unsafe socializing (H1) will be strongest amongst younger individuals (ages 18-39) who regularly engaged in the same behaviours prior to the pandemic.[7]

Experiment

We tested these hypotheses using a between-subjects experiment with one treatment group and one control group (see Supplementary Materials for preregistered trial design). We recruited an online sample of 910 residents of British Columbia, Canada, of whom 600 are representative of the general population; the remaining 310 constitute an additional oversample of people aged 18-39. The survey was in the field from November 4-23, 2020. See Supplementary Materials for summary statistics of key variables, broken down by age group.[8]

Treatment

Half of our sample was assigned to an ambiguous-message treatment group. The other half was assigned to a control group (no message). The treatment message was designed to highlight the ambiguity of public health messaging during the first year of COVID-19:

Figure 1. Ambiguous treatment message

The BC Centre for Disease Control (BC CDC) has provided guidelines on safe social gatherings during the COVID-19 pandemic. Here are a few things to remember in any situation:

- *It's important to avoid large gatherings and stay away from other people who are ill. However, getting together with others is important to our wellbeing.*
- *Most people with COVID-19 recover. However, people with chronic diseases are also at higher risk of death if they become ill.*
- *Remember to stay at least 2 metres (6 feet) from anyone outside of your immediate household or outside of your social group. However, 1 metre (3 feet) is also okay if you're with the same group of people you know and see regularly, such as work colleagues and classmates.*
- *Wearing a cloth mask might not protect you from COVID-19. However, it is a good option in situations where you cannot keep a safe distance from others for an extended period of time.*

This message is a composite of real advice from the BC Centre for Disease Control (CDC). Each bullet contains two sentences drawn from the BC CDC website or public briefings. The first sentence in each bullet contains either a factual claim (e.g. 'Most people with COVID-19 recover') or behavioural guidance (e.g. 'It's important to avoid large gatherings and stay away from other people who are ill'). The second sentence is designed to nuance the first without directly contradicting it. In each case, the second sentence begins with the word 'However' to emphasize the contrast. These statements can both be true without contradiction, but the combination creates room for different interpretations, depending on how much weight is placed on each. The messages in these examples are relatively unambiguous in isolation.

The control group received no message, which reflects the 'state of nature' at the time of our study. We assume that, in the context of our study, public health information was less ambiguous for respondents in the control than those in the treatment condition. To be sure, in the 'real world,' individuals may have been exposed to ambiguous messaging from public health officials over time. For example, respondents almost certainly would have seen public health messaging to avoid large gatherings; they would also have likely seen the somewhat contradictory messaging that emphasized the value of socialization for wellbeing. However, respondents in the control condition were unlikely to have seen both messages simultaneously and immediately next to one another. This informational context is precisely what individuals in our treatment condition experienced—an intervention designed to highlight real ambiguities in public health messaging. In our Supplementary Materials, we provide some examples of messaging that the authorities from BC were sharing with the population at the time of our study.

In designing our treatments, we sought to address one of Bertelli and Riccucci's (2020) main critiques of experimentally-driven, behavioural public administration—namely, inattention to practicality. We sought to manipulate ambiguity, which is something that elected officials and public health authorities can feasibly change without redesigning government institutions. This allows us to make nuanced, actionable recommendations for public managers. In our discussion section, we acknowledge the potential for instrumental ambiguity, and recommend officials limit ambiguity to the logic *behind* the guidance rather than the guidance itself. Additionally, we were careful not to provide additional information to respondents beyond what was communicated in prior government messages. For instance, we did not propose new, hypothetical restrictions simply to amplify (or reduce) ambiguity. Such a choice might have made sense from an experimental perspective, but it would have been of limited value for governments, which at the time paid great attention to the specific content of public health messaging.

Variables

Inferences (dependent variable): After showing participants the ambiguous message (or not, for the control group), we asked them to infer the appropriateness of several behaviours: '*Imagine you have NO symptoms of the coronavirus. Which of the following behaviours are you currently expected to avoid?*.' Respondents were given a list of 10 behaviours, only 5 of which public health authorities actually expected them to avoid at the time of our study—e.g. *'Hosting several friends at your home (more than 6, less than 50)'* (see Supplementary Materials Figure S2 for a full list). We calculate the proportion of factually correct responses as our measure of inferences.

Prospective Behaviour (dependent variable): We also measured each participant's intentions to comply with public health guidance: '*In the next 30 days, how many days do you expect to...'*. Participants were shown 6 behaviours similar to those in the inference question (visit a bar or a pub; visit a nightclub; attend house parties; eat at a restaurant; share food, drinks or smokes; attend social gatherings of more than 6 people). We calculate the total number of socializing acts across the six behaviours. The resulting variable ranges from 0 (0 days for all six behaviours) to 180 (all six behaviours, every day). In this sense, the unit of measure is the number of unsafe activities anticipated over a 30-day period.

Retrospective Behaviour (independent variable): Earlier in the survey, prior to random assignment and exposure to treatment, we asked a similar question about the respondent's social activity before the pandemic: '*For the following questions, we would like you to think back to a year ago before COVID-19. If you can't remember exactly, please give your best estimate. A year ago, how many days a month on average would you get together socially with others, like friends or family?*.' We calculate the total number of socializing acts across the same six behaviours from our measure of behavioural intentions.[9] To be clear: Our data is not longitudinal in the sense of repeated measures of the same respondent across multiple data collection events. We ask each respondent to estimate socializing behaviour before and during COVID-19. All responses come from a single survey session.[10] Consistent with our dependent variable, the unit of measure is the number of unsafe activities reported over a 30-day period.

In the Supplementary Materials, we present our trial design (Figure S1) as well as descriptive information about these variables. For example, Tables S1 and S2 present summary statistics. Table S1 shows that respondents aged 18-39 reported an intention to engage in an average of 4.65 unsafe socializing activities over the following 30-day period (SD = 18.15). Overall, we find strong skew in this variable, with only 40% of respondents aged 18-39 reporting any intention of engaging in unsafe socializing and 15% saying they would engage in five or more unsafe activities over the next month. In Table S3, we present balance tests. They show no evidence of imbalance across a range of pre-treatment variables, including age, gender, and citizenship. In Figure S2, we plot the proportion of respondents that correctly identified each activity as one that the BC CDC expected them to avoid.

Statistical Tests

Below, we use linear regression to test our three hypotheses. For hypothesis 1, we regress both inferences about unsafe behaviour and intentions on a treatment indicator to test whether the inferences and intentions of respondents in the treatment group are less in line with public health guidelines than those in the treatment group. For hypothesis 2, we include an interaction between prior social activity and the treatment indicator to test if the correlations between prior social activity, on one hand, and current inferences and intentions regarding unsafe socializing, on the other, are stronger among respondents in the treatment group. In order to speak to hypothesis 3, analysis of the interaction between the treatment and prior social activity, with respect to current inferences and intentions, is stratified by age (those 18-39 years old vs. those 40+). This analysis plan was pre-registered with the Open Science Framework (but see fn. 7, above).

Results

In Table 1, we explore the effects of the ambiguous message on inferences and intentions regarding unsafe socializing, without considering prior behaviour. We regress each of the two dependent variables on the treatment variable. In Model (1), we find no effect for the ambiguous message on inferences about correct behaviour (p = 0.731). Individuals in both the treatment and control groups made correct inferences, on average, 83% of the time. In Model (2), we also found no effect for the ambiguous message on behavioural intentions (p = 0.906). Individuals in both the treatment and control groups indicated they were going to engage in about four unsafe activities over the next month.

Table 1. OLS Regression Results (H1: inferences & intentions)

	(1) Dependent Variable: Inferences					(2) Dependent Variable: Intentions				
			95% CI					95% CI		
	Estimate	*SE*	*LL*	*UL*	*p*	Estimate	*SE*	*LL*	*UL*	*p*
Treatment (control)	0.006	0.018	-0.029	0.041	0.731	-0.142	1.199	-2.495	2.211	0.906
Constant	0.831*	0.013	0.806	0.856	<0.001	4.379 *	0.847	2.716	6.042	<0.001
N	910					897				

Note. Unstandardized OLS coefficients. * $p < 0.05$

We next look at how the ambiguous message interacts with retrospective behaviour to influence inferences and prospective behaviour. In Table 2, we regress inferences on the treatment variable with an interaction on retrospective behaviours. Model (1) shows the results for participants aged 18-39. Column 2 shows the results for those aged 40+. We find that each additional retrospective behaviour (prior engagement in a behaviour now considered unsafe) reduces the accuracy of inferences by 0.5 percentage points (p <0.001 for both age groups), but, importantly, this small effect is the same for those in treatment and control.

Table 2. OLS Regression Results (H2 and H3: inferences)

	Dependent Variable: Inferences									
	(1) Ages 18-39					(2) Ages 40+				
			95% CI					95% CI		
	Estimate	*SE*	*LL*	*UL*	*p*	Estimate	*SE*	*LL*	*UL*	*p*
Treatment (control)	0.026	0.030	-0.033	0.085	0.388	-0.020	0.028	-0.076	0.036	0.481
Retrospective behaviours	-0.005*	0.001	-0.007	-0.003	<0.001	-0.005*	0.001	-0.007	-0.003	<0.001
Treatment (ambiguity) x Retrospective behaviours	0.0003	0.001	-0.002	0.002	0.798	0.001	0.001	-0.002	0.004	0.535
Constant	0.876*	0.022	0.834	0.919	<0.001	0.910*	0.020	0.870	0.950	<0.001
N	498					398				

Note. Unstandardized OLS coefficients. * $p < 0.05$

In Table 3, we examine behavioural intentions. Models (1) and (2) show results for those aged 18-39 and 40+. This time, we see that the treatment strengthens the relationship between retrospective and prospective behaviour (interaction P-value < 0.001). The consequence is that those who used to engage in behaviours that are now considered unsafe are affected by the ambiguous information such that they are more likely to engage in those behaviours in the future. Looking across age groups, we find the treatment effect is not statistically significant amongst those 40 years and older, while it is significant amongst those under 40.

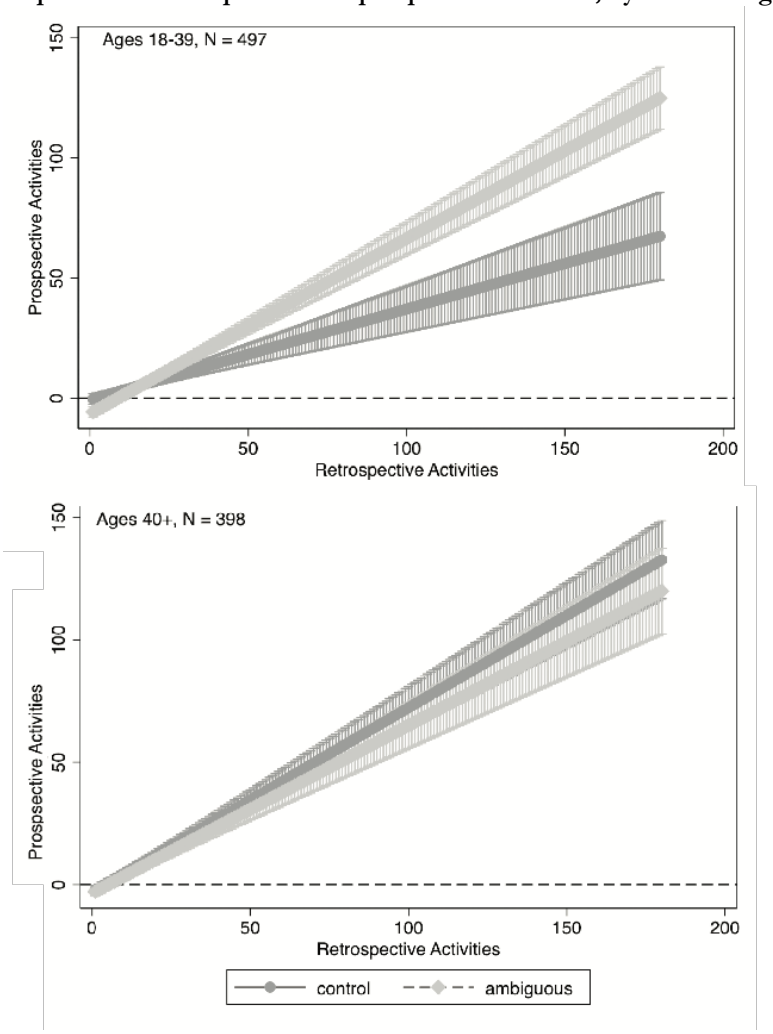
Table 3. OLS Regression Results (H2 and H3: intentions)

	Dependent Variable: Intentions									
	(1) Ages 18-39					(2) Ages 40+				
			95% CI					95% CI		
	Estimate	*SE*	*LL*	*UL*	*p*	Estimate	*SE*	*LL*	*UL*	*p*
Treatment (control)	-5.766*	1.564	-8.839	-2.693	<0.001	-0.316	1.430	-3.126	2.495	0.825
Retrospective behaviours	0.379*	0.055	0.270	0.487	<0.001	0.755*	0.048	0.661	0.849	<0.001
Treatment (ambiguity) x Retrospective behaviours	0.352*	0.068	0.218	0.486	<0.001	-0.069	0.071	-0.208	0.070	0.328
Constant	-0.744	1.130	-2.963	1.476	0.511	-3.160*	1.018	-5.161	-1.158	0.002
N	497					398				

Note. Unstandardized OLS coefficients. * $p < 0.05$

In Figure 2, we visually represent the relationship between retrospective and prospective behaviour, and how it differs by age between those in the control and ambiguous treatment groups. The gap in the two slopes is the treatment effect and is greatest at higher levels of retrospective activities—but only for those under 40 years old.

Figure 2. The relationship between retrospective and prospective activities, by treatment group and age



Notes: Linear correlations between retrospective and prospective activities among those in the control (dark gray) and ambiguous treatment (light grey) groups, across those aged 18-39 and 40+.

In short, we find that people who received an ambiguous message about COVID-19 made similar inferences about correct behaviour compared to those who received no message (contrary to H1). However, we find the effect of ambiguous messaging on intentions to engage in unsafe socializing is strongest amongst those who regularly socialized prior to the pandemic (H2), specifically among those aged 18-39 (H3).

Discussion

When people confront ambiguity, their underlying motivations may influence how they process information and make decisions. We theorized that people who were highly social before the pandemic may engage in directional motivated reasoning via disconfirmation bias—that is, people may counter-argue against public health restrictions to justify socializing during the pandemic. For example, someone who wants to attend a house party might focus on ambiguity in public guidance, allowing them to interpret that guidance in ways that justify their preferred behaviour. We believe this type of directional motivated reasoning has been a

challenge during COVID-19 (Sylvester, 2021). In the context of social distancing and 'superspreader' events, we hypothesized that younger people were more likely to exhibit directional motivated reasoning than older individuals, leading them to counter-argue public health guidance and justify unsafe socializing.

In a pre-registered experiment from November 2020, we examine the effect of ambiguous messaging on people's inferences about and intentions to engage in unsafe socializing. We find no evidence of an effect on inferences—that is, people who receive an ambiguous message about COVID-19 make inferences that are similar to the inferences of those who receive no message. However, and consistent with our expectations, we find ambiguous messaging increases unsafe socializing intentions among highly social people aged 18-39. Notably, these effects are localized among a narrow group: Just 40% of respondents aged 18-39 reported any intention of engaging in unsafe socializing over the next 30 days, with 15% saying they would do it five times or more.[11] In other words, the localized effects we find are consistent with other evidence showing a small number of superspreader events may account for a large majority of COVID-19 cases in some jurisdictions (Miller et al., 2020).

How can we account for the somewhat paradoxical finding that ambiguous messaging seemingly encouraged unsafe behavioural intentions, even as it did not lead to less accurate inferences about public health recommendations? We believe part of the explanation lies in the distinction between *ideal* and *permissible* behaviours. In asking about public health authorities' expectations regarding behaviours to avoid, we may have focused participants' attention strictly on the ideal—perception of which, our results suggest, was not affected by exposure to ambiguous public health messaging. However, among those motivated to perceive unsafe socializing as permissible, the ambiguous messaging may have made it easier to imagine a larger range of behaviours as acceptable, though maybe not ideal. This enlarged scope of perceived permissible behaviours may, in turn, have made it easier—particularly for those who engaged in high levels of pre-pandemic socializing and for whom such socializing was personally important—to imagine themselves engaging in a range of 'borderline' behaviours that those in the control group were less likely to see as permissible. Future research might examine the importance of this ideal-permissible distinction by, for instance, inquiring about behaviours that are 'allowed' in addition to asking about behaviour that should be 'avoided.'

We conclude with three policy considerations. First, to the extent possible, we urge simplicity over complexity in the communication of COVID-19 and other public health behavioural guidance. We recognize complexity may be instrumental. Complex messages that present more than one dimension or 'side' of a particular issue may enhance the credibility of public health messaging—a communication strategy that would be consistent with extensive research on two-sided advertising (Eisend, 2006). Similarly, recent evidence suggests ambiguity can promote transparency, increasing trust and acceptance of well-defined behaviours like getting vaccinated (see Petersen et al., 2021). That said, we recommend public health officials limit ambiguity to the logic *behind* the guidance (e.g. 'Why get vaccinated?'), rather than the guidance itself (e.g. 'Is vaccination recommended?'). Our results highlight an awkward trade-off for communicators. Complex, nuanced messaging may offer citizens more information and, in the long run, enhance communicators' credibility; however, it may simultaneously make it easier for (some) citizens to persuade themselves that less-than-ideal behaviour is socially permissible. Whether the long-run benefits of credibility and trust are fully offset by the immediate cost of promoting suboptimal behaviour depends on the circumstances of a given campaign. Following Bertelli and Riccucci (2020), we believe this insight helps build knowledge for the practice of public administration because it acknowledges that political realities and operational goals are not always aligned, especially in governance contexts, where ambiguity is common (Moynihan 2006).

Second, we see an urgent need for field research on 'de-biasing' measures that offset motivated reasoning. Such measures could include digital messaging interventions that prime accuracy motivations—i.e., interventions that encourage people to accurately process information about COVID-19. One option could be to focus on reputational concerns, e.g. a social media post encouraging the viewer to 'Think of yourself as an example to others' or 'Think about what message your behaviour sends to others.' Drawing people's attention to social judgements may encourage deliberation and help people avoid directional motivated reasoning. Another option is to emphasize the stakes. People who engage in unsafe behaviours may justify it by minimizing the impact on others.[12] Clarifying the likely consequences of an unsafe decision—either in

human lives or health—may help citizens align on a shared understanding of reality. Such an approach would align with recent research in behavioural public administration, which shows that de-biasing may be more effective among citizens than among elected officials (Christensen & Moynihan 2020).

Finally, we caution that behaviour-change campaigns should not be one-size-fits-all. Messaging should be sensitive to the perspectives of those who would most benefit from intervention. In our study, the effects of ambiguity seem limited to a small group: those under 40 who were highly social prior to the pandemic. However, the nature of coronavirus spread in many jurisdictions makes this an important group to target and underscores the need to consider how this group might respond to ambiguous messaging. This is important: Messaging that targets all young people without distinction has the potential to create a backlash. When the provincial premier of BC suggested that younger individuals needed to do more, he subsequently walked back his comments in response to a strong reaction from younger individuals. Those who did not engage in unsafe socializing felt they were already making a bigger sacrifice than older individuals, who socialized less before the pandemic (Judd, 2021; McElroy, 2021). Tailoring communication by population subgroup is important for public managers responsible for future compliance-related behaviour change campaigns—especially given recent calls to embrace heterogeneous treatment effects in behavioural science (Bryan et al. 2021) and behavioural public administration (Bertelli et al. 2022).

Notes

1. This definition of ambiguity involves a subjective estimation that people will feel multiple interpretations of a given message are equally valid. This is different from polysemy, whereby information is lexically or objectively open to multiple interpretations (Lupker, 2007).
2. As Druckman and McGrath (2019) note, it is not easy to mechanistically observe motivated reasoning. Consider a liberal voter who selectively avoids conservative news that downplays the severity of COVID-19. It is unclear whether this voter avoids conservative news because it is attitudinally incongruent (i.e. advancing directional goals) or because they believe the source is not credible on this issue (i.e. advancing accuracy goals). This is the 'observational equivalence' problem (114). We recognize this is an important issue. While we believe directional motivated reasoning is a plausible explanation, we are somewhat agnostic on the issue of mechanisms in our experiment. Our immediate aim is to understand whether (as opposed to exactly why) ambiguous messaging on COVID-19 may undermine government's efforts to discourage unsafe socializing intentions.
3. More generally, ambiguity may promote motivated deception—lying to oneself and others (also called 'elastic justification' in Hsee, 1996; Hsee, 1995; and Schweitzer & Hsee, 2002). Similar work in legal studies shows people may justify ethically dubious behaviour when they perceive rules as ambiguous (e.g. Feldman, 2018; Feldman et al., 2013).
4. Bellé et al (2018) conduct a series of experiments with public servants in Italy, showing evidence of heuristic-based decision-making among policy actors too.
5. Several public administration scholars also consider ambiguity inside government. For example, Moynihan (2006) argues ambiguity leads policymakers to overlook contextual differences when considering policy options. The result is the adoption of 'superficially similar' concepts that, in reality, are sufficiently different to affect implementation. Cairney et al. (2016) adopt a boundedly rational perspective to argue framing effects help policymakers reduce ambiguity in complex decision environments. Noordegraaf and Abma (2003) argue ambiguity is a key obstacle when policymakers try to implement 'management by measurement.' Olsen (2014) challenges conventional wisdom that ambiguity weakens accountability. He argues ambiguity may strengthen governance—for example, by facilitating political compromise that both parties can interpret as a victory.
6. We have slightly reworded H2 from our pre-registration: "the correlation between prior behaviours, on one hand, and current inferences and intentions, on the other, will be stronger among those who receive the ambiguity message relative to people in the control condition". We do this for clarity, as the rephrasing is functionally equivalent to the original.
7. This was not a preregistered hypothesis. However, the preregistration did include a split sample analysis of the data by age. The preregistered oversampling of those 18-39 years old also reflects our intention to

analyze these two groups separately. We selected 40 years as our age cutoff to reflect the BC CDC's administrative categorization, which combines people in their 20s and 30s into one category and people in their 40s and 50s into another.

8. Our project was approved by the Research Ethics Board at Simon Fraser University (Protocol no. 2020s0335).
9. We also invited respondents to download Canada's exposure notification app, called COVID Alert. The app is only operational in certain provinces, and we included this question in case it became operational in BC while the survey was in the field. It did not.
10. Additionally, our data were not extracted from a larger study and there are no other published studies from this dataset.
11. In this sense, our findings follow previous work showing differences in motivated reasoning across populations. For example, Lind et al. (2018) consider motivated reasoning about the relationship between refugee inflows and crime. Using a survey experiment among Swedish adults, they find that participants with high numeric ability were less likely to engage in motivated reasoning, relative to those with lower levels of numeric ability.
12. This approach builds off recent work by Christensen and Moynihan (2020). Working with a sample of Danish politicians and members of the public, they test whether requiring people to justify a decision can offset motivated reasoning. Their experimental results show an important difference by population: Justification requirements might work for members of the public, but can actually encourage political elites to double down on biased decision-making.

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