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### Metaphor and Memory: How Metaphors Instantiate Schemas in and Influence Memory of Narrative

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Metaphor and Memory:  
How Metaphors Instantiate Schemas in and Influence Memory of Narrative

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**Abstract**

Metaphoric frames are prominently featured in public discourse. They highlight certain aspects of the target issues they are used to describe, thereby encouraging specific patterns of inference. Our goal was to test whether they would influence memory as well. Building off prior work, we contrasted two metaphors for crime: virus and beast. In a pilot study, we identified specific causes, examples, and solutions to crime that were congruent with each frame (one but not the other; e.g., people thought “drug use” better exemplified a crime virus, whereas “murder” better exemplified a crime beast). Participants ( $n = 469$ ) read or listened to a short metaphorically-framed crime report, completed a filler task, and were prompted for the information they had seen/heard. Results indicated the virus metaphor facilitated memory, overall, but not the specific frame-congruent information, suggesting a more general influence of the frame than predicted.

Key Words: metaphor, memory, schema, perception

## Metaphor and Memory:

### How Metaphors Instantiate Schemas in and Influence Memory of Narrative

#### **Introduction**

Ken Kesey, author of *One Flew over the Cuckoo's Nest* is famous for saying, "To hell with facts! We need stories" (Christelis, 2015). While some might vehemently deny the truth of this statement, it is often the norm in human communication. Stories are inextricably linked to the way people think. Ted Sarbin (1986) even posited the idea of narrative as the "root metaphor" of, or framework for, psychology. Some researchers believe that stories are vital for linking a person to their society and argue that the way in which individuals engage in cultural narratives shapes their greater understanding of their identity within a society as well as their relation to those outside of it (Hammack & Pillecki, 2012). This form of cultural storytelling can most clearly be seen in news media. From Ronald Reagan's declaration of a "War on Drugs" to the perpetuated narrative of the mentally-ill mass murderer, narratives and narrative framing are a fundamental aspect of how politics and news are conveyed to the public (Elwood, 1995; Carey, 2016). Instead of shaping arguments based purely on fact, politicians and other public speakers use rhetorical devices and narrative form to try to persuade listeners of their own point of view. These portrayals are not without influence: in fact, the framing of political speeches and news coverage can have wide-ranging effects on public perceptions.

One such rhetorical form is the metaphor. Metaphors can turn a complex or distressing concept into something much more straightforward and understandable for the public. So, by the magic of words, politicians, like former President Reagan, can turn the complexities of the federal budget into a much more comprehensible idea: a baby, with "an insatiable appetite at one end and no sense of responsibility at the other" (Read, Cesa, Jones, and Collins, 1990). Yet by

making the federal budget more understandable, Reagan also puts forward a very specific interpretation of how it works. From media's substantial use of metaphor rises an important question: does metaphoric framing influence memory as well as perception?

One group of researchers came close to answering this question. In 1990, Read, Cesa, Jones, and Collins examined how participants remembered and responded to short narratives, framed with metaphors such as "Giving loans to Zaire was like offering crates of whiskey to an alcoholic". They found that starting a short passage with a metaphor increased memory for the information contained within the passage, particularly if the participants were exposed to the narrative auditorily. But these researchers only examined how much participants were remembering, not what information they remembered. There is no mention of whether the information recalled was highly relevant to or consistent with the metaphor given, which leaves the burning question – do metaphors influence memory in a systematic way? After all, metaphors create a connection between two unlike ideas, so as to produce new associations that the target (the idea being described by the metaphor) would not otherwise have. We argue that metaphors create these associations through the instantiation of schemas of the metaphor source – the concept used to describe the target.

Throughout the course of this paper, we will begin by exploring the history of research on narrative and narrative framing. We will then turn to the current research on the effects, persuasive or otherwise, of metaphoric framing specifically. From there, we will explore how metaphors relate to and instantiate schemas, creating a narrative out of disconnected concepts. This will bring us to the current studies we performed to determine whether metaphors, when embedded into narratives, can instantiate schemas, and therefore systematically influence memory.

### **Narrative Framing**

Storytelling has been a part of humanity since time immemorial. Although story schemas - the precise structures of and within narrative - can change from culture to culture or era to era, the continued presence of stories is a testament to humanity's persistent love of narrative (van Dijk, 1977; Kintsch, Mandel & Kozminsky, 1977). But narrative is not just beloved and shared, it is changed through the process of transmission. In the seminal research by F.C. Bartlett (1932), narratives were read, recalled, and transmitted through generations of participants, so that each participant read the version of the narrative from the person before them and changed the narrative through their own recall – a process Bartlett called “serial reproduction”. Over the course of generations, the narratives underwent a series of changes: information became emphasized or deemphasized based on the cultural background and particular points of view of the participants. However, one limitation of Bartlett's research is that it was not systematized – he did not control the changes and frames produced by the participants, so it is unclear which aspects of one narrative produced which alterations in the recall of another participant. Fortunately, since Bartlett, many researchers have tackled the idea of narrative transmission and framing.

One such researcher is Shanto Iyengar, who created a number of studies examining the presentation of news stories. In particular, Iyengar examined three major forms of media influence: agenda-setting, priming, and framing (Iyengar & Simon, 1993). The first, agenda-setting, is the way in which a topic's presentation can influence its perceived importance. The perceived primary agendas of the nation or the world are set by the presentation of otherwise inaccessible information. As a result, an issue featured prominently in edited news shows is considered to be much more important by viewers than other issues. In this way, news media can

shape which aspects of current events are considered relevant or, by highlighting their campaign, make a presidential candidate a serious contender (Iyengar, Peters, and Kinder, 1982). The second, priming, allows for viewers to more easily access information related to that presented in a news program. For example, if a person viewed coverage of the Gulf War about twenty years ago, the Gulf War would be a larger factor in their assessment of George Bush Sr.'s competence as a president (Iyengar & Simon, 1993).

But of greatest interest to our research question is the Iyengar's third interest – framing, or the presentation of a story. The way in which a news story is presented can heavily influence not only how people perceive an issue, but also how they wish to respond to it. Respondents to Iyengar's survey who watched more of the highly militaristic press coverage of the Gulf War were much more likely to express support for a militaristic rather than a diplomatic response to the crisis. By viewing stories where the conflict was presented as militaristic, respondents were more likely to adopt that viewpoint and see a militaristic solution to a militaristic problem. The way in which media coverage is framed changed the way in which people viewed the crisis and its solution (Iyengar & Simon, 1993).

However, framing can have persuasive effects not just when using a particular tone or perspective, but also when using metaphors. Thibodeau and Boroditsky (2011) examined how two metaphors about crime can influence participants' perspectives and decisions related to crime. When reading a short narrative about crime, participants who were exposed to a metaphor which described crime as a *virus infecting a city* were more likely to support policy decisions such as eradicating poverty and improving education. Meanwhile, participants who read a metaphor describing crime as a *beast preying on a city* were more likely to support jailing criminals and enacting harsher enforcement laws. These changes in participants' perspectives

and solutions to the city's crime problem were even larger than those produced by either political affiliation or gender – indicating a large shift in perspective even through the use of a one-word metaphor. Thibodeau and Boroditsky's (2011, 2013) metaphors were most persuasive when included early in the narratives. It is likely, therefore, that the metaphors are shaping how participants understand the issue and encode its contents – producing a particular point of view for their readers. This finding was supported by Sopory and Dillard's (2015) meta-analysis of metaphoric persuasion, which found that using a single metaphor early in a message is the most effective in terms of producing attitude change compared to non-literal statements.

As a result, changes in metaphoric framing – and therefore in the perspectives of the populous - can have wide-spread implications for public policy. In his infamous “War on Drugs” statement, Reagan framed drugs and their sources as enemies to be defeated. By instantiating this framework, Reagan set into motion a number of policies, which treat drug offenders as enemies of the state instead of non-violent criminals, a choice which has expanded the United States' prison population to the largest in the world (Branson, 2012). But this metaphor influenced not only the harsh tactics used to deal with America's complicated relationship with drug use and distribution, it also fostered many metaphorical children, including the War on Religion, the War on Terror, and the War on Cancer. These metaphors of war bring whole new connotations to the conflicts they describe, pushing for a clear, quick victory using aggressive action and strength (Elwood, 1995).

However, a metaphor frame may not always fit the behavior it seeks to change. The metaphor of war removes all thought of compromise, peace, and negotiation, which have connotations of weakness in the face of danger. Such thinking reduces the options which seem viable to those who adopt it, even when those options are a poor choice in weapon (Elwood,

1995; Coleman, 2015). Cancer, for example, is not something that can be wholly destroyed; for as long as we have cells, we can expect there to be copying errors that may result in cancer (Coleman, 2015). However, “the War on Cancer” implies that if we use radical and experimental treatments for cancer, we will be victorious over it and eradicate it forever. But this metaphor, as Hauser and Schwarz (2014) found, not only perpetuates aggressive treatments but reduces reliance on preventative measures, such as eating healthy and avoiding carcinogenic substances. Self-limiting does not match with the idea of fighting an enemy (i.e., a war schema), so it is not a course of action which is considered, to the detriment of individuals’ health (Hauser & Schwarz, 2014).

But while we know that metaphors can be extremely persuasive and potentially dangerous, we have little idea how they affect memory. Research regarding memory and metaphor is far more uncommon than research concerning metaphor and persuasion. Unfortunately, what little research that exists is primarily associated with the memory of metaphors themselves rather than any surrounding or associated material. Richard Harris (1979) showed participants a series of novel metaphors, “dead metaphors”, and non-metaphoric statements, in order to see which of those three categories were remembered best, believing that the vivid novel metaphors would be more easily remembered than either clichéd “dead metaphors” or non-metaphoric statements. While Harris found that metaphors were remembered no better or worse than non-metaphoric statements, his research was fraught with methodological problems, including using the aforementioned arbitrary categorization of the statements as metaphors, “dead metaphors”, and non-metaphorical statements. This arbitrary categorization would be excusable – for sometimes instinct is the only option available for categorization – if the metaphors he used were actual metaphors. However, the phrases used were not so much

metaphors as personification (e.g. "The ivy cuddled up to the window", as compared to the "dead metaphor" of "The ivy crept up to the window" and the nonmetaphoric "The ivy grew up to the window"). While there is some comparison between the ivy and a person curled up with a loved one, there are so many different possible implications given by the word "cuddled", any associations are unspecific. Then, since these "metaphors" possessed no actual comparison between a source and target, it is uncertain whether they would work the same way cognitively as actual metaphors.

Although Allyssa McCabe's (1988) article on memory of metaphor is more methodologically sound than Harris' work, her research still did not involve the surrounding information. While she manipulated the context in which the metaphors were shown in order to better replicate actual exposure to metaphors, McCabe's work once again looks at metaphors as the dependent measure, rather than the manipulation. She simply wished to determine under what contexts metaphors were best remembered. Therefore, we are left with two important questions: if metaphors can change perspectives and increase persuasion, can they also alter memories in similarly systematic ways? And if they can, *how* do they do so?

### **Instantiating Schemas**

Our theory is that metaphors create associations with different schemas – specific knowledge structures – with the information they describe – commonly referred to as their targets. Through their connections to these schemas, metaphors can affect how people attend to the information they are processing and how they represent it in memory. Schemas – while known to influence memory, particularly in the case of eyewitness crimes, where schema-typical information is remembered much better over the long term (see: Graesser et al., 1980; Brewer & Treyens, 1981; Hastie & Kumar, 1979) – have been considered integral to how narratives are

remembered since reproductions of Bartlett's research. Kintsch and Greene (1978) found that one of the major reasons that Bartlett's participants changed the narrative they read was because of the narrative's use of unfamiliar story schemas. As a Native American folktale, Bartlett's infamous "The War of the Ghosts" short story used terms and concepts, as well as the narrative structure itself, which were foreign to the European-American participants. Since the participants did not have the knowledge structures to represent them, information related to these unfamiliar schemas was lost.

However, metaphors convey a series of benefits that do not come with schemas. Like schemas, metaphors have a strong influence on cognition, even shaping the way people think about abstract concepts (see: Conceptual Metaphor Theory [CMT] from Lakoff & Johnson, 1980). For example, time is often described in terms of space – time *flies by* much like landscape does on a road trip and the future is *ahead* like a traveler's next destination (Lakoff & Johnson, 1980) - and power and valiance are both explained with verticality – with *up* being stronger or more positive, while *down* is weaker or more negative (Meier & Robinson, 2004; Schubert, 2005). In this way, metaphors hold sway over the way people comprehend the world (e.g., Jia and Smith, 2013; Williams & Bargh, 2008). As previously mentioned, metaphors are known to increase persuasion (Sopory & Dillard, 2002) and can influence what solutions people either select or come up with for problems that have been framed with particular metaphors (Thibodeau & Boroditsky 2011, 2013). But above all else, it is our belief that metaphor framing allows the speaker to control not only which schemas but also which *aspects* of those schemas are accessed by participants.

By using a metaphor, the same concept can affect the listener in an entirely different way by accessing specific aspects of the schema. For example, in the metaphor *she was lost in a sea*

*of grief*, grief is associated with a turbulent sea and contains similar properties: loud, harsh, confusing, violent, and removing any sense of control from the individual. However, a different variation on a source can produce vastly different connotations for the same target. Instead of describing grief as a turbulent ocean, another metaphor – *she drifted on the flat sea of grief* – compares grief to a still ocean: expansive, empty, never-ending, isolating, and draining. While both metaphors use the same schema of the sea, they each take very different aspects of it to describe the emotional state of a grieving woman. If she stood in the grocery store, staring at the cereal options, and unable to make a decision, is it because of the maelstrom of emotion impeding her decision or is the emptiness so overwhelming that such a decision seem impossibly exhausting? Would she respond positively or negatively to outside stimulus? A person's choice could easily be swayed one way or the other depending on which of the sources – the maelstrom or the empty expanse - is used.

### **The Present Studies**

Our goal, then, is to determine whether metaphor can systematically influence not just people's perspectives on a given issue, but also their memory *of* that issue. In order to determine the extent to which metaphor can influence memory of a narrative, we have expanded upon the metaphors of Thibodeau and Boroditsky, which describe crime as either a *beast preying upon a city* or as a *virus infecting a city*, to create a short narrative about crime in the fictional city of Addison (2011, 2013).

To do so, we conducted two norming studies and an experiment. The first norming study was designed to gauge the associations that people have with crime. The second was designed to measure whether these common associations are more consistent with a *virus* schema for crime or a *beast* schema for crime. In the experiment, we included some information that was more

consistent with a *virus* schema and some information that was more consistent with a *beast* schema. Half of the participants were presented with a report in which crime was metaphorically framed as a *virus*, while crime was described as *beast* to the other half.

Our prediction was that framing crime as a *virus* would instantiate a particular knowledge structure in the minds of the reader that would lead them to remember frame-consistent information better than frame-inconsistent information. This result would mimic those of eyewitness reports of crimes, which find that schema typical information is better remembered over the long term (e.g., Graesser et al., 1980; Brewer & Treyens, 1981; Hastie & Kumar, 1979). Participants were exposed to the narrative in either text or audio form, both to mimic the style of a political address or radio news, as well as to see whether we could replicate the results from Read et al. – that information with a metaphor frame is more readily recalled when presented orally (1990).

### **Norming Study 1: What do people associate with crime?**

#### **Method**

##### **Participants**

100 American participants (49.5% male) were recruited from and paid through from Amazon Mechanical Turk. The average age of these participants was 19.49 years old. While 85% of participants identified as white, 10% identified as Black or African American and 8% as Asian. These participants were most strongly Democrat (42%), with another 23% considering themselves Republican, 31% Independent, and 4% other. On a scale from 0 (Very Liberal) to 100 (Very Conservative), participants' mean ideology was 43.25. The majority (36%) of participants had attended a 4-year college, while the next group (24%) had attended at least some

college; only 11% of participants had a high school education or less and 20% had done some post-graduate work. When asked which metaphor was a more appropriate metaphor for crime, 75% of the participants thought it was the *virus* metaphor, while only 25% believed it was the *beast* metaphor.

### **Materials and procedure**

Norming Study 1 was used to gauge what people think are the typical causes, examples, and solutions to crime. Participants were asked to list 5 causes of crime, 5 types or examples of crime, and 5 approaches or solutions to crime. Participants were then asked to list 2 causes of, types of, and approaches to crime that they thought were most consistent with the two metaphor frames: *virus* and *beast*. Participants were not instructed to think of novel causes, examples, or solutions for each section— in some cases participants repeated responses that they had previously given; in other cases, participants provided novel information.

After to responding to these questions, participants answered a series demographic questions, including their age, gender, ethnicity, first language, level of education, socioeconomic status, country of residency, and political affiliation and ideology.

### **Results**

The responses of the participants were grouped into 16 different categories of causes of crime, 12 different categories of examples of crime, and 12 different categories of solutions to crime, that emerged from reading the range of responses. In Table 1, these responses have been abbreviated to the five most common categories for each information type (cause, example or solution).

Overall, causes of crime tended to refer to issues at the societal level. Problems with unemployment, the economy, drug use, or education were often considered to be causes of

crime. Very few causes of crime are focused on individuals, such as crime being caused by an intrinsic trait in the criminals. On the other hand, examples of crime were often focused on the individual, with murder, larceny, and robbery among the most common responses. Finally, solutions to crime were mixed: some suggestions, such as increasing police presence, promoting stricter punishments, and creating a neighborhood watch, were focused on individual criminals while others, such as education and economic reform, examined crime at a societal level.

When the general suggestions were compared to those for the *virus* and *beast* metaphors, the proportional number of causes, examples, and solutions in each category differed by request type. Causes focused on infrastructure, such as economic problems, poor education, and drug use, were much more heavily favored for *virus* metaphor. Meanwhile, violent crimes, such as murder and sexual assault, were much more frequently chosen in for the *Beast* metaphor.

Table 1.

Top 5 most frequently mentioned causes, examples, and solutions to crime

Crime Categories	Information Type	Percent of Virus Responses	Percent of Beast Responses	Percent of General Responses
Economic	Cause	19.19	10.61	16.95
Drugs	Cause	17.17	12.63	12.57
Environment	Cause	9.26	7.58	9.91
Intrinsic	Cause	5.56	14.65	8.08
Organized Crime	Cause	6.57	11.11	6.62
Murder	Example	7.07	24.24	15.71
Larceny	Example	14.65	8.59	12.23
Robbery	Example	10.10	11.11	11.45
Drugs	Example	22.22	9.60	11.11
Assault & Battery	Example	6.06	9.60	10.25
Increase Policing	Solution	29.80	35.61	25.65
Education Reform	Solution	10.10	7.58	12.12
Stricter Punishments	Solution	11.11	18.67	10.49
Neighborhood Watch	Solution	8.08	9.60	10.44
Community Programs	Solution	4.55	4.55	9.43

Note. The categories are displayed in descending order of percent total of suggestions within Information Type. “Drugs” were considered both a cause – such as someone robbing a bank in order to obtain enough money to buy heroin – and example – drug use or sale is illegal – of crime

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by participants. The “Intrinsic” category refers to intrinsic traits within a criminal that would predispose them to committing crimes. “Larceny” refers to theft without threat of violence, while “Robbery” refers to theft with threat of violence.

## **Discussion**

In this study, we developed a picture of how people tend to think about various aspects of crime, including some of the most common causes, examples, and solutions to crime. We also started investigating relationships between the metaphors and the aspects of crime that they tend to associate with. When considering the *virus* metaphor, participants tended to respond more frequently with causes relating to infrastructure – such as education, the economy, or drug use – than when responding to the *beast* metaphor. When responding to the *beast* metaphor, participants were much more likely to mention sudden violent crimes like murder or sexual assault than when responding to the *virus* metaphor. We expand on this investigation with in a more targeted norming study below.

## **Norming Study 2: What do people associate with crime viruses and crime beasts?**

### **Method**

#### **Participants**

200 American participants (52% male) were recruited from and paid through Amazon Mechanical Turk. The mean age of participants was 21.86 years old. The vast majority of participants were white (81%), while only 7% identified as Black or African American, and 6% as Asian. Most participants (34%) had received a bachelor’s degree and 67% had at least some college education. Meanwhile, only 12% of participants had a high school education or less and 16% had done at least some post-graduate work. Democrats made up the majority of participants (48%), while Republicans made up 23%, Independents 27%, and 1% other political affiliations.

On a scale from 0 (Very Liberal) to 100 (Very Conservative), participants' mean ideology was 39.87. Once again, the majority of participants viewed the *virus* metaphor (60%) as more appropriate than the *beast* metaphor (40%), though the difference was less extreme than with Norming Study 1.

### **Materials and procedure.**

From the categories of causes, examples, and solutions to crime found in Norming Study 1, fifteen causes, examples, and solutions of crime were selected. The pieces of information were selected from the most frequent responses of Norming Study 1, so that all the major categories of crime were represented. Care was taken not to have pieces of information overlap – e.g., although larceny and robbery are considered different crimes by law (the latter involving threats of violence while the former does not), they were considered functionally the same in this study. The causes, examples, and solutions were also chosen to likely be associated with one metaphor or the other, though some were chosen precisely because of their ambiguity. “Neighborhood watch”, for example, is a solution to crime that in previous experiments by Thibodeau and Boroditsky (2011, 2013), has been associated with both *beast* and *virus* metaphors, and we were curious whether this group of participants would more strongly associate it with one metaphor or the other.

Participants made two judgments about each piece of information. First, they were asked how consistent each cause/example/solution of crime was with the metaphors (two questions, one for each metaphor). Participants rated each of the forty-five crime-related pieces of information on a scale from 1 (*Very Inconsistent*) to 7 (*Very Consistent*) with the *beast* and *virus* metaphors, separately. Then participants were asked about the salience of each piece of information. After rating each of the causes, participants were asked to what extent they agree

that that cause is “a major cause of crime”, from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*).

After each example of crime, participants were asked how common a crime they believed it was on a scale from 1 (*Extremely uncommon*) to 7 (*Extremely common*). Finally, after each solution to crime, participants were asked how effective they believed each solution to crime would be, from 1 (*Very Ineffective*) to 7 (*Very Effective*).

After they had finished rating the forty-five crime-related pieces of information, participants were asked the same series of demographic questions from Study 1. In addition, participants were asked about a series of questions about their personal experience with crime, from rating the seriousness of crime in their communities to whether they or someone they know have ever served time in jail or is currently working in law enforcement. Participants were also asked whether they believed that the virus or beast metaphor was more appropriate to describe crime overall.

## **Results**

The forty-five pieces of information were analyzed using paired sample t-tests, which compared the ratings for consistency with the *virus* and *beast* metaphors. Overall, the results were quite polarized. Nearly all of the causes and solutions were rated as more consistent with the *virus* metaphor than the *beast* metaphor (only four out of the thirty causes and solutions were consistent with the *beast* metaphor, two for causes and two for solutions), while almost all of the examples were considered more consistent with the *beast* metaphor (only two out of the fifteen examples were consistent with the *virus* metaphor). However, the strength of this relationship varied considerably depending on the piece of information. Out of these forty-five pieces of information participants rated, twelve were selected to use in the narrative, which were most strongly consistent with either the *beast* or *virus* metaphor. Four causes, examples, and solutions

were selected, such that there would be little overlap between pieces of information and that were two per crime type that rated most strongly toward each metaphor (see Table 2).

Table 2.

Mean Differences for the Twelve Most Strongly Beast and Virus Causes, Examples, and Solutions to Crime

Information Type	Information	$M_{diff}$	95% Confidence Interval	
			Lower	Upper
Cause	Family/Upbringing	1.01	0.691	1.32
Cause	Lack of Community	1.04	0.771	1.31
Cause	Lack of Police Presence	-0.296	-0.587	-0.006
Cause	Organized Crime	-0.523	-0.883	-0.162
Example	Drug Sale	0.593	0.271	0.915
Example	Prostitution	0.608	0.299	0.917
Example	Murder	-2.38	-2.68	-2.07
Example	Rape	-2.28	-2.6	-1.95
Solution	Increase Rehabilitation	1.18	0.893	1.469
Solution	Increase Mental Health Services	1.05	0.762	1.34
Solution	Increase Police Presence	-0.412	-0.668	-0.156
Solution	Increase Punishments	-0.94	-1.21	-0.667

Note: All pieces of information chosen were found to be significantly *virus*- or *beast*-consistent. The mean difference ( $M_{diff}$ ) from these paired sample *t*-tests is measured by  $M_{virus} - beast$  such that the more negative a  $M_{diff}$  score is, the more strongly consistent with the *beast* metaphor it is.

## Discussion

During this experiment, we found the 12 causes, examples, and solutions to crime that were the most polarized: the most strongly consistent with either the *virus* or *beast* metaphors. Six pieces of information, two per information type, were chosen for each metaphor. Some

consideration was made to make sure pieces of information would not overlap, but otherwise the pieces of information chosen for the narrative were those which were most consistent with one of the metaphors. The most polarized information was used in the hope that it would be most easily primed by the metaphor with which it was consistent, if the relationship between them was strong. However, the selection process was simplified by the polarization of the information types – causes and solutions were almost always consistent with the *virus* metaphor while the examples were almost always consistent with the *beast* metaphor. This trend may indicate that the *virus* and *beast* metaphors are instantiating entirely different ways of examining crime. The *virus* metaphor may prime participants to consider the fuller context of a given crime, like the full course of a disease: both the virus itself (the cause) as well as its treatment (the solution), not just the symptom (the example) it produces. Meanwhile, the *beast* metaphor may only prime participants to see the crime itself, rather than the factors surrounding it.

### **The Main Study: How do the virus and beast metaphors influence memory of the narrative?**

#### **Methods**

##### **Participants**

500 American participants were recruited from and paid through Amazon Mechanical Turk. However, 27 participants were removed from the sample because they had participated in at least one of the previous studies. Another four participants were removed due to copy-pasting the narrative or inability to hear the audio, leaving a total of 469 participants for analysis.

Of the remaining participants, 59% were female and the average age was 20.27 years old. As with the previous two studies, 82% of participants were white, while 10% were Black or

African American, and 5% were Asian. Democrats made up the majority (44%) of participants, while Independents (32%), Republicans (21%), and other political affiliations (3%) fell behind. On a scale from 0 (Very Liberal) to 100 (Very Conservative), participants' mean ideology was 40.88. As with the previous two studies, the *virus* metaphor was considered more appropriate than the *beast* metaphor for crime by 78% of participants.

### Materials and procedure

There were two metaphor framing conditions (*virus* or *beast*) and two modalities of presentation (written or auditory), which yielded four between-subjects conditions. Participants were randomly assigned to one of the four conditions. Everyone was exposed to the twelve causes, examples, and solutions to crime that emerged as most consistent with the two frames in Study 2, making information type (cause, example, and solution) and information metaphor (whether a piece of information is *beast*- or *virus*-consistent) within subjects measures. In the narrative shown below, the *virus*-consistent information is underlined and the *beast*-consistent information is bolded; the *virus*- and *beast*-consistent information was intermixed in order to prevent the creation of recency or primacy effects – no metaphor would dominate the beginning or end of the narrative.

Crime is a [virus infecting/beast preying on] the city of Addison. It has crept into every crevice of life in this small city. Five years ago Addison was in good shape, with no obvious vulnerabilities. Unfortunately, in the past five years the city's defense systems have weakened, and the city has succumbed to crime. Today, there are more than 55,000 criminal incidents a year - up by more than 10,000 per year. Thomas Wilson, Mayor of Addison, is now calling for a rise to action.

“The brutal **rape and murder** of local high school student, Marissa Lee, was really the last straw for Mayor Wilson,” said a confidential source inside the mayor's office, “He called in the chief of police and yelled about how **the police were sitting on their butts instead of patrolling around schools, protecting our children**. I'd never seen him that angry before.”

Mayor Thomas Wilson believes a primary concern to be a lack of community within the city. “We need to find a way to come together again as a city and rebuild our true identity, not this invasion of **gangs** and fear that has overrun us. Parents have been sitting back instead of getting invested in their children’s lives, allowing them to be corrupted by these scoundrels”, said the mayor during his emergency press conference.

Unfortunately, Marissa Lee is far from the only victim of Addison. The rapid rise in **criminal organizations** has destroyed untold number of lives, through both the sale of both sex and narcotics. There is great concern that **new sex workers are being coerced** under these operations and are unable to leave without fearing for their own or their families’ safety. With the way events are headed, there is a worry that if the city does not regain its strength soon, even more serious problems may start to develop.

But there is still hope for Addison. Mayor Wilson plans on pushing for **a larger and better-equipped police force to patrol the city**, as well as **increasing punishments for any lawbreakers caught within his jurisdiction**.

But these are not the only changes Wilson plans on making, “We must get our citizens the treatment they need. We can get as many officers as we want, but if we cannot destroy the demand for drugs through rehabilitation, nothing will change.” In addition, Wilson demands that better mental health services be provided for both victims of crimes perpetrated in Addison and the members of our police force who have been exposed far too much suffering in the line of duty.

Mayor Wilson will have to push these changes through the city council, who are not known for their proactive stance, so only time will tell whether these policies will come to fruition.

Participants were instructed to read (or listen to) the narrative carefully. They were not told to try and commit the narrative to memory or that they would be asked to recall the narrative from memory.

After exposure to the narrative, participants were asked to complete a five minute filler task: 25 arithmetic problems. Then participants were probed for their memory of the report in two ways: first, they were asked to write as much of the information from the report that they could remember in a free recall task. The participants then underwent a recognition memory task in which participants had to check which of a series of eight causes, eight examples, and eight solutions were actually present in the narrative, half of which actually were present in the narrative, while the other half were not.

In the free recall task, participants were asked to type as much of the narrative as they could in the span of five minutes, which was monitored and restricted through Qualtrics' timing mechanism. Then they were given lists of causes, examples, and solutions to crime – the recognition task. Four items of each list were in the narrative, while another four were other items from the list of forty-five causes, examples, and solutions from Study 2 that were never mentioned within the narrative. Participants were asked to check which items they could remember from the narrative. After completion of the recognition task, participants were given the same series of demographic questions as in Study 2, then paid.

Although the participants worked without supervision through Qualtrics, a timer monitored and recorded the amount of time participants spent on each page. It also informed the participants how much time had passed. These pages would automatically cut forward after the time limit had been reached, to prevent participants spending more than the allotted time on tasks.

### **Planned Analysis**

When examining the free recall data, information which was present in the narrative was checked off, so that a participant could receive anywhere from zero to twelve checks. These checks belonged to one of two levels of the within subjects measure of information metaphor – whether the information itself was consistent with the *beast* or *virus* metaphor – as well as the information type – whether it was a cause, example, or solution. In the recognition task, participants were asked to check which of a list of eight causes, examples and solutions each were present in the narrative. Checks were considered either a correct response, if the item had been in the narrative, or an intrusion, if the item was not. The correct responses were analyzed separately from the intrusions. Responses to both tasks were therefore analyzed based on two

between subjects factors - framing metaphor (*virus* or *beast*) and modality (text or audio) – as well as three within subjects measures – the information metaphor (*virus* or *beast*), information type (whether it was a cause, example, or solution), and the memory task (free recall or recognition).

For analyzing both the free recall and recognition data, a logistic regression was run, rather than an ANOVA or ANCOVA, since ANOVAs can lead to spurious results when examining categorical outcome variables (Jaeger, 2007). In every analysis, the deviance between the models (i.e., difference in likelihood ratios) is reported as an index of model fit: model deviance approximates a chi-square distribution with the number of added parameters as its degrees of freedom (Menard, 2002).

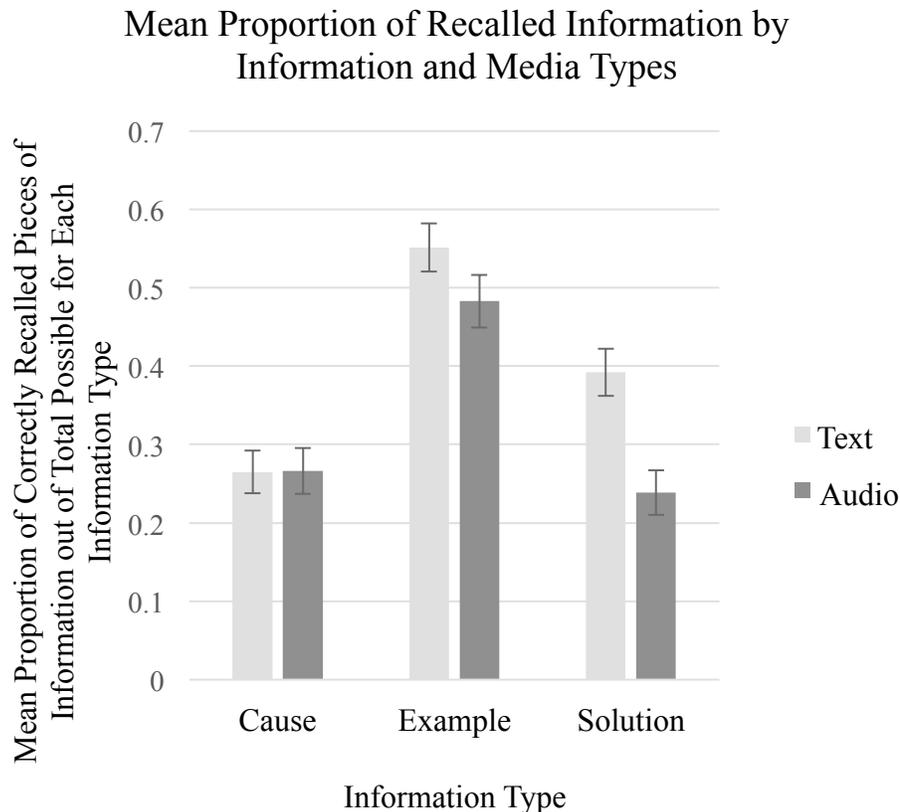
## Results

### Free Recall

In the Free Recall task, participants were asked to write down as much as they could of the narrative they had either read or listen to, which had been framed with either the *beast* or *virus* metaphor. If metaphors instantiating schemas, as we predicted, then participants should who received the *beast* metaphor should remember more *beast* consistent information, while those who were exposed to the *virus* metaphor should do the opposite. The free recall data was analyzed using a logistic regression; however, intrusions were not measured, since it would be a considerable undertaking to measure the consistency of unknown pieces of information with the *beast* and *virus* metaphors.

Participants showed a main effect of media type on their recollection,  $\chi^2(1) = 15.072$ ,  $p < .001$ . They were more likely to recall information that was read than heard. A sizable main effect was also found for information type – whether the piece of information was a cause, example, or

solution,  $\chi^2(2) = 13.939, p < .001$ . Examples of crime were remembered far more readily than either causes or solutions. An interaction was also found between media and information type,  $\chi^2(2) = 30.838, p < .001$  (see Figure 1), such that solutions to crime were remembered far better when the narrative was read rather than heard.

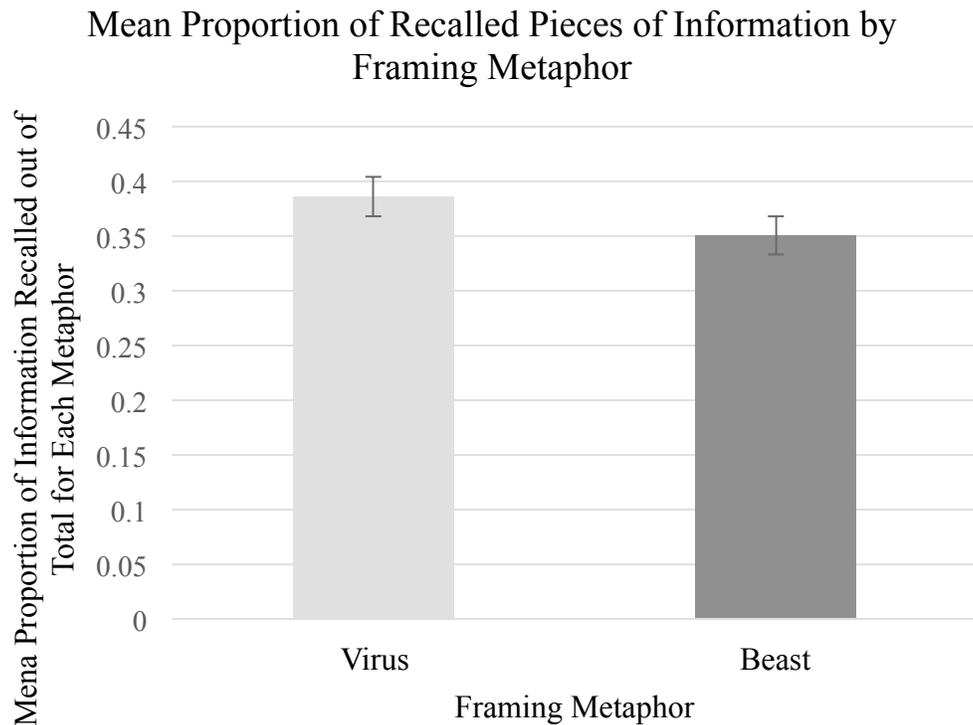


**Figure 1.** The significant interaction between information and media types for the recall task. Solutions were much more readily recalled when the narrative was presented as text. The bars represent the average proportion of correct responses out of the total possible within that group (i.e., a participant could remember anywhere between zero and four causes, so a bar around 0.5 would indicate that the average participant remembers two out of the four possible causes to recall). All figures measure recall in the same way.

We did find a main effect for the metaphor frame,  $\chi^2(1) = 4.513, p = .034$  (see Figure 2).

Participants who were given the *virus* metaphor at the beginning of the narrative were able to recall more information overall than those who were given the *beast* metaphor. However, the

expected interaction between metaphor frame and information type did not appear,  $\chi^2(2) = 2.864$ ,  $p = .239$ ; nor was there a three-way interaction between metaphor frame, information type, and media type,  $\chi^2(3) = 4.001$ ,  $p = .261$ .



**Figure 2.** The main effect of metaphor on recall. As shown above, participants who were exposed to the *virus* metaphor recalled more overall.

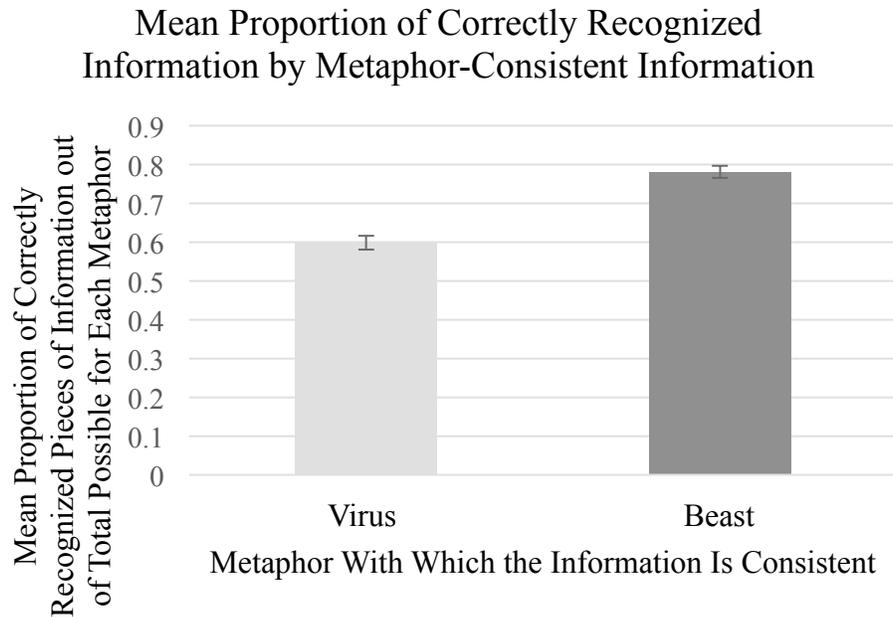
### Recognition

In the recognition task, participants were asked to check which of a series of 8 causes, examples, and solutions to crime were present in the narrative they had read, where 4 of each group had been present, while the other 4 had not. Participants who received the *beast* metaphor should have more easily recognized the *beast* consistent information, while the reverse was true of those who received the *virus* metaphor frame. Unlike with the free recall task, the logistic regression found no main effect was found by information type – whether the piece of

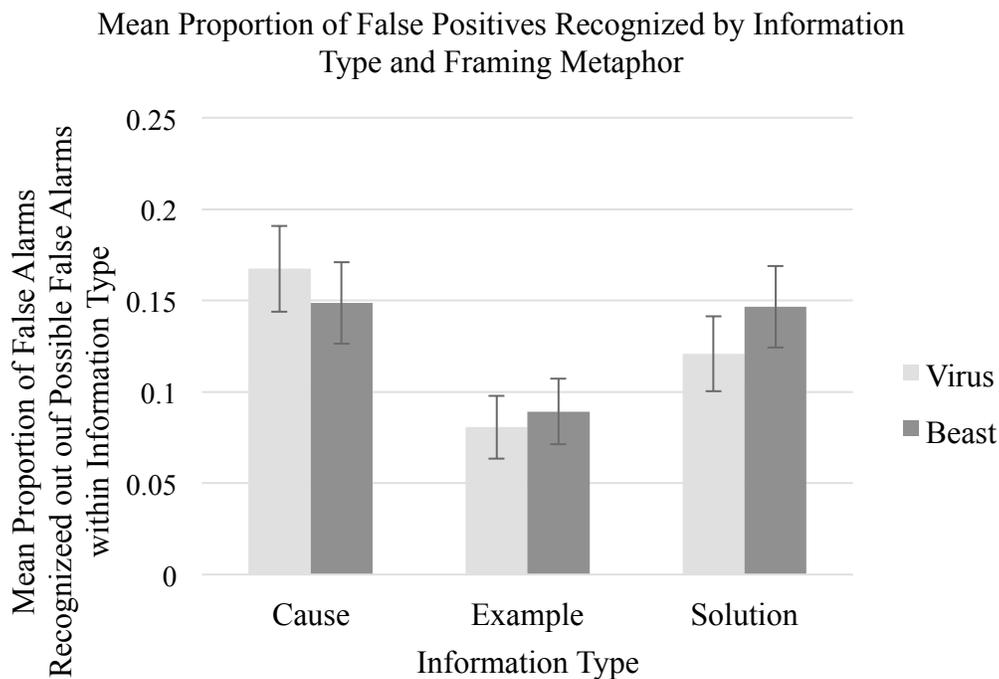
information was a cause, example, or solution ( $\chi^2(2) = 1.207, p = .547$ ). Also unlike in the free recall task, participants did not differ in their recognition of information by framing metaphor ( $\chi^2(1) = 1.234, p = .267$ ).

Similarly to the free recall task, there was a main effect of media type – whether the participant was exposed to the narrative in text or audio form. Participants recognized more information when it was presented in a text narrative than audio,  $\chi^2(1) = 24.923, p < .001$ . There was also a main effect of metaphor-related information,  $\chi^2(1) = 6.309, p = .012$ . Participants more easily remembered information from the narrative that was rated as consistent with the *beast* metaphor in Norming Study 2 than information that was more consistent with the *virus* metaphor (see Figure 3). The logistic regression also found an interaction between information type and media,  $\chi^2(2) = 16.694, p < .001$ . While participants were more likely to remember examples over causes and solutions, this effect is much more extreme for participants who listened rather than read the narrative. However, the logistic regression found no interaction between metaphor and information type ( $\chi^2(2) = .563, p = .755$ ) or a three-way interaction between metaphor, information type, and media,  $\chi^2(3) = 1.18, p = .758$ , which were the two hoped-for interactions.

The intrusions were also analyzed in the same manner as the correct responses, using a logistic regression. Only a marginally significant interaction between information type and metaphor was found,  $\chi^2(2) = 4.871, p = .0876$  (See Figure 4). While false positives for causes were more common for those given the *virus* metaphor, participants exposed to the *beast* metaphor made more intrusions for examples and solutions.



**Figure 3.** This figure displays the main effect of metaphor-consistent information on recognition. *Beast*-consistent information was much more readily recalled than *virus*-consistent information.



**Figure 4.** The average proportion of intrusions (false positives) recognized by framing metaphor and information type, a marginally significant interaction. Participants who were given the *beast* metaphor were much more likely to make false positives for solutions than any other information type.

## Discussion

In three experiments, we examined how participants relate to crime and interact with metaphors about crime. In the Norming Study 1, we surveyed participants for the first crimes, as well as the causes and solutions to crime, that came to mind, as well as which crime-related information they associated with two metaphors. The first metaphor described crime as *a beast preying on the city of Addison*, while the second viewed crime as *a virus infecting the city of Addison*. We found that participants were more likely to mention causes of crime at the societal level, such as economic difficulties or education deficits, which more clearly line up with the *virus* metaphor. Meanwhile, participants usually thought of examples of crimes at the individual level – particularly violent crimes such as murder or rape – which fit the *beast* metaphor. Solutions to crime were more mixed: while some targeted the problem of crime on the societal level, such as suggestions for economic reform, other participants pushed for solutions to crime that would affect individual criminals, such as instituting a neighborhood watch.

In Norming Study 2, we examined these relationships more closely, determining which of the forty-five categories produced were most consistent with the *beast* and *virus* metaphors, so that they could be used to create a narrative filled with the most strongly polarized information. As with the first norming study, causes and solutions were so strongly consistent with the *virus* metaphor, that there were only two causes and solutions which were significantly more consistent with the *beast* metaphor than the *virus* one. Likewise, only two examples of crime were significantly more consistent with the *virus* metaphor than the *beast* metaphor. These atypical causes, examples, and solutions were included in the main study's narrative so participants would be exposed to both *virus* and *beast*-consistent information of all three information types.

In our main study, the narrative created from these *beast*- and *virus*-consistent pieces of information was framed by one of the two metaphors and presented in either a written or audio form in order to see whether these metaphors will systematically influence the memory of this information. We believed that participants who received the *beast* metaphor would be more likely to remember information that was most consistent with the *beast* schema, while participants who were exposed to the *virus* metaphor would remember more *virus*-consistent information. We did not expect, however, there to be differences in the how the metaphors affected memory depending on whether participants were engaged in the recognition or free recall tasks.

In the recognition task, we found the greatest effect of the metaphors in what information was *misremembered* by participants. Participants who received the *beast* metaphor were more likely to falsely recognize solutions to crime that were not a part of the narrative than those who received the *virus* metaphor. If such an effect could be replicated, it could have wide-ranging implications for the realm of politics. Using particular metaphors might allow politicians to convince their audiences of the truth of specious facts, even if those facts are only associated with the ideas mentioned in their speeches. After all, if people are more likely to believe that they have been exposed to a cause or solution to crime before, they may be more likely to believe the cause is true or that the solution would be effective – an example of the illusory-knowledge effect (see: Begg et al, 1996). The *beast* metaphor is of particular concern because participants were more likely to correctly recognize *beast*-consistent information, particularly if they heard the narrative rather than read it. Perhaps the *beast*-consistent information was more easily recognized because of its stronger negative emotional valiance. Crimes such as murder and rape are likely considered more strongly negative than prostitution or drug use and may be

more likely to be recalled as a result – an outcome of our negativity bias (Amabile, & Glazebrook, 1982).

By contrast, in the free recall task, participants showed a difference in recall based on the information type – whether the piece of information was a cause, example, or solution to crime. Examples of crime were recalled far better than either causes or solutions. Once again, this may be tied into the stronger emotional valiance of the examples when compared to the causes or solutions. However, participants who read to the narrative remembered far more solutions than those who read it. This result conflicts strongly with the auditory recency effect (also known as the modality effect), which suggests that people are better able to remember information they have recently heard (Penney, 1989). Further research is required to unpack the full extent of this result. But of greater relevance to our hypothesis, there is an effect of the metaphor frame: participants who were exposed to the *virus* metaphor remembered more overall than those who received the *beast* metaphor. While the metaphor used did not systematically affect what participants could recall, it still shaped their overall ability to recall information.

The fact that participants exposed to the *virus* metaphor remembered more causes, examples, and solutions indicates that perhaps the *virus* schema instantiates a full sequence of events rather than an isolated incident. When a person becomes ill, they are ill because of a virus or bacteria (causes), which induces specific symptoms (examples), and can be treated through specific measures, such as medication or bed-rest (solutions). Meanwhile, when a person contemplates the idea of a crime as a beast, they may be more likely to think of a singular event – the beast’s attack – rather than considering why a beast might attack or how to prevent further attacks. Perhaps attacking is simply considered an aspect of the beast’s nature, rather than the result of any outside influence, so no causes are looked for. If these *beast* and *virus* schemas are

considered in such a way, this could explain why participants who were given the *virus* metaphor were able to remember more than those given the *beast* metaphor – they were primed for that sequence of occurrences rather than an isolated event.

However, further study is required to fully understand how these metaphors are affecting memory. One other question of note would be how these effects would change with an alteration in the time between encoding and recall. Would increasing the distance between exposure to the narrative and the recall of its contents increase these effects, since more information which is considered irrelevant would have been forgotten; or would the reverse be true, as the metaphors themselves are forgotten?

### **Conclusion**

Metaphors, regardless of the precise details of the schemas involved, do appear to instantiate schemas and influence memory as a result. While this effect is not strong enough or precise enough to make specifically targeted pieces of information more memorable, metaphors can still effectively shape what types of information are perceived as important and, therefore, are remembered. In order to more fully explore this phenomenon, further research must be done, not only with the metaphors used in this study, but with other similarly polarized metaphors as well to determine how widespread this effect truly is.

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