Original Research Article

How Are Competitive Framing Environments Transformed by Person-to-Person Communication? An Integrated Social Transmission, Content Analysis, and Eye Movement Monitoring Approach

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Abstract
Person-to-person communication is ubiquitous in everyday life, yet the literature on framing has not examined how the content and number of frames change when transmitted across individuals. In Study 1, we use the serial reproduction paradigm to examine how person-to-person communication and message length influence the number of frames in the information environment. In Study 2, we use eye movement monitoring to examine whether individuals direct greater attention to pro- or counter-attitudinal frames in a competitive framing environment. We find that the process of retelling frames from person to person can transform an environment containing multiple competing frames into an environment with a single frame. This is important given work showing that framing effects in competitive environments are more likely to cancel out. Furthermore, message length and prior attitudes play important roles in determining whether individuals direct attention to, remember, and transmit frames.

Keywords
framing, competitive frames, social transmission, eye movements, memory

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On June 23, 2016, the people of Great Britain voted to leave the European Union (EU), an event that has come to be known as "Brexit." In the months leading up to this historic vote, there was intense debate about how the possibility of leaving the EU should be viewed. A recent content analysis of newspapers in the United Kingdom found that those supportive of leaving the EU argued that it was a way of "getting our country back" (Khabaz, 2018). Meanwhile, those campaigning to stay in the EU argued that the move constitutes "leaving economic strength in favor of unnecessary risk" (Lindenberg, 2017). Interpersonal discussions surrounding the topic of Brexit occurred throughout Great Britain in various online forums and across social media (Herrman, 2016).

In the language of communication research, voters in the United Kingdom were exposed to "competing frames" (Chong & Druckman, 2007a), that is, when multiple groups use different frames—regaining national sovereignty versus economic risk and uncertainty—to influence voters' attitudes. This real-world example raises important questions about how frames originating from the media environment are reflected in interpersonal discussions. For example, when individuals encounter competing frames, which frames do they communicate to other people? What factors influence people's ability to convey frames to others?

Much of the work on framing in the context of politics does not answer these questions. For example, there is qualitative work that has investigated how interpersonal discussion transforms collective action frames from political elites via in-group pressures (Gamson, 1992; Walsh, 2004). However, this work does not address competing frames about a particular issue and cannot speak to specific psychological mechanisms that determine why frames from the media environment change over the course of person-to-person communication. Furthermore, the preponderance of experimental framing research has focused largely on the effects of frames on people's attitudes or "framing effects" (Busby et al., 2018; Lecheler & de Vreese, 2011; Nelson, Clawson, & Oxley, 1997; Scheufele & Iyengar, 2017).[1] Although this work is valuable, we know very little about whether, and how, frames from the media environment change when conveyed from one individual to another.

This is an important gap in the scholarly literature for two reasons. First, much of the information people encounter in their everyday lives is obtained secondhand through interpersonal channels (Hirst & Echterhoff, 2012). Individuals obtain political information from family, friends, and colleagues who, in turn, can pass this information on to others (Carlson, 2019; Katz, 1957; Katz & Lazarsfeld, 1955). Second, work across various fields has shown that social information can change drastically from its original version as it is communicated from person to person (Allport & Postman, 1947; Bangerter, 2000; Bartlett, 1932; Carlson, 2017; Gamson, 1992; Mesoudi & Whiten, 2008; Walsh, 2004). Thus, knowing how competitive framing environments can be transformed by person-to-person communication can provide insights about how they affect attitudes and behaviors.

The goal of this study is to examine how competitive framing environments can change as competing frames are retold from person to person. Across two studies, we provide a theoretical view of how memory and attention influence how frames transform as they are retold. In our studies, we use news stories that contain two opposing

or competing frames. In the first study, we use the serial reproduction paradigm—an experimental paradigm often used in studies of cultural evolution (Bartlett, 1932; Mesoudi & Whiten, 2008)—and content analysis of people's retellings to examine how person-to-person transmission of competing frames affects the number of frames in the information environment. We also examine how message length, and attitudes about the frames, can influence people's ability to remember frames. In the second study, we use eye movement monitoring to examine whether attitudes about a frame influence the amount of attention people direct to it. Our theoretical framework suggests that attention directed to information can influence individuals' ability to remember frames, and hence their capacity to convey the frames to others. Thus, by examining both theoretical mechanisms that are present in all individuals (memory, attention) and features of social communication (person-to-person transmission of information), our work can provide a fuller picture of the cognitive and social factors that explain how and why people transform frames from the media environment as they convey this information to others.

Person-to-Person Transmission and Remembering Frames

Experimental work on framing in political contexts has largely focused on how frames influence people's attitudes or "framing effects." Generally, this work has gone through two stages. In the first stage, work on framing focused on the effects of single frames. In these studies, individuals were exposed to just one of two alternative frames. For the most part, this work reported evidence of strong framing effects (Nelson & Oxley, 1999; Nelson, Oxley, & Clawson, 1997; for a review, see Chong & Druckman, 2007b). That is, when people are exposed to a specific frame (e.g., regaining national sovereignty), their attitudes are swayed in the direction of the frame (e.g., increased support for Brexit).

The second stage of research has provided new approaches, including work on competitive frames (Chong & Druckman, 2007c, 2010; Druckman & Nelson, 2003; Matthes & Schemer, 2012; Nisbet et al., 2013; Sniderman & Theriault, 2004). This body of work attempts to capture an important facet of the real-world information environment: Individuals at any point in time regularly encounter multiple frames from different political actors (e.g., politicians, journalists, interest groups, media organizations). These studies typically expose the same individuals to two or more alternative frames. Research on competitive frames has found that exposure to multiple and competing frames can, under certain conditions, lead to their effects canceling out, thus eliminating framing effects (Chong & Druckman, 2007a).

The present study builds on and contributes to research on competitive frames. In this study, by the term "frame," we are referring to Druckman's conceptualization of a "frame in communication" or "media frame." That is, a frame refers to "words, images, phrases, and presentation styles that a speaker (e.g., a politician, a media outlet) uses when relaying information about an issue or event to an audience" (Chong &

Druckman, 2007c, p. 100).[2] Furthermore, we follow Cacciatore et al.'s (2016) recommendation to explicitly distinguish emphasis from equivalency frames. We focus on emphasis frames in this study.

Much of the research on competitive frames neglects an important channel by which frames can be communicated in everyday life: Individuals are not only exposed to frames through mass-media channels such as news websites, television programming, and radio shows but through interpersonal discussions as well.[3] This notion that political information can move from the media to opinion leaders who, in turn, pass the information to others is reflected in prominent models such as the "two-step flow" of communication (Katz, 1957). Indeed, there is evidence that person-to-person transmission of political information is prevalent. In the United States, for example, individuals often report getting news information from friends and colleagues (Carlson, 2019).

This process in which individuals retell political information to friends, family members, and colleagues, who, in turn, can retell it to others has important consequences for the social transmission of competitive frames. Although a person may initially be exposed to multiple competing frames in the media environment, they may only convey one particular frame when discussing the issue with someone else. Such a process may transform an information environment initially containing multiple frames into a single framing environment. By "single framing environment," we are referring to an information environment in which individuals are exposed to only one frame. This single frame may not necessarily be the same frame for different individuals (e.g., one individual may encounter the "regaining national sovereignty" frame, while another individual encounters the "economic risk and uncertainty" frame). Understanding how person-to-person communication can change the number of frames in the information environment is important given previous work indicating that the number of frames people are exposed to can determine the strength of framing effects.

What factors, then, determine the extent to which frames are retold to another person? One important factor is people's ability to remember frames. When an individual wishes to share information they previously encountered (e.g., a news story containing two or more frames), the process of disseminating this information with another person is theorized to involve at least two stages (Bebermeier et al., 2015; Bratanova & Kashima, 2014; Echterhoff & Kopietz, 2018; Pasupathi, 2007). First, the speaker retrieves from memory the information to which they were previously exposed. Second, the speaker selects the information that will be shared with others. The speaker may decide to convey everything they remember or to pass along a small subset of information. This decision regarding how much and which type of information to discuss can be influenced by factors such as the goals of the speaker and the characteristics of the audience (Joshi et al., 2016; Joshi & Wakslak, 2014; Lee et al., 2014). Under this model, however, the ability to select information to convey to others is critically dependent upon people's ability to remember the information in the first place; speakers do not have the option to share information if they do not possess memory for that information. Furthermore, theoretical models of framing effects either explicitly or

implicitly assume that individuals need to possess memory for frames in order for them to exert effects on attitudes and behaviors (for a review, see Chong & Druckman, 2007b). Thus, understanding how people remember (or forget) information about frames is important for determining how frames are transformed over the course of person-to-person communication.

One of the most important and least controversial claims from memory research in the last 50 years is that human memory is not perfect. According to this theoretical view, memory is not a literal reproduction of the past but rather is a constructive process (for a review, see Schacter, 2012). As a consequence, memory is prone to errors. One of the most common sources of errors in memory reconstruction is forgetting—instances in which individuals fail to remember specific pieces of information when they reconstruct the past.

Forgetting can be due to several reasons. First, information may have degraded from memory (Baddeley, 1976, 1998). This has been shown to occur over long (days, years) and short (minutes, seconds) periods of time (Peterson & Peterson, 1959; Schacter, 1996; Wixted & Ebbesen, 1997). Second, individuals may not have sufficiently paid attention to information when they were first exposed to it. This process of storing information into memory is often referred to as "encoding" (Baddeley et al., 2009, pp. 44–59). As a result, individuals may have poor subsequent memory for that information (Craik & Tulving, 1975).

Combining these processes that lead to forgetting with person-to-person communication produces an important implication: Retellings will increase the likelihood that information or frames are lost. Every time information is retold from one person to the next, it provides an opportunity for forgetting to occur for the conveyor of the information. Thus, the retelling of competing frames can increase the likelihood that frames are forgotten leading to a decrease in the number of frames in the information environment. Formally, we propose the following hypothesis:

Hypothesis 1: As the number of retellings increases over the course of person-to-person communication, the number of frames within a given retelling will decrease.

However, one important factor that could influence people's ability to remember (or forget) frames is the length of the message. In the case of news stories delivered via text or interpersonal messages transmitted through text-based mediums (e.g., email, certain social media messaging platforms), message length can refer to the number of words used to convey the ideas the message producer intends to communicate. The number of words used to convey information about the frames can vary. People's visual system, however, has a limited capacity (for a review, see Driver, 2001), and people must direct their gaze to specific areas in their visual field to select stimuli (e.g., words) for further visual processing. Longer messages (i.e., greater number of words) can lead to an uneven distribution of visual attention to parts of the message (e.g., frames) in comparison with shorter messages. That is, individuals may be able to direct greater attention to all parts of shorter than longer sentences that convey frames. Greater levels of visual attention are linked to better memory for information (Loftus,

1972; Neuschatz et al., 2002; Pertzov et al., 2009). Thus, shorter messages may facilitate better memory for frames. We therefore propose the following hypothesis:

Hypothesis 2: As message length decreases, people will be more likely to remember frames.

To summarize, it is important to determine the extent to which person-to-person retellings will decrease the number of frames in the information environment (Hypothesis 1) given that person-to-person communication is ubiquitous in everyday life and the number of frames people are exposed to can influence framing effects. Specifically, framing effects tend to be stronger in single framing than competitive framing environments. It is also important to determine the extent to which message length influences memory of frames (Hypothesis 2) because media channels (e.g., Facebook, Twitter) can vary in the limitations they impose on message length or their tendency to foster certain habits in message construction. Various media may have different effects on people's ability to remember information about frames.

Study I

Method

Participants. We recruited a total of 99 participants from a large Midwestern university and the surrounding community in the United States. All participants were compensated with US$15 for taking part in the study. We excluded three participants who encountered technical problems with our software that prevented recording of their responses. We analyzed data from the remaining 96 participants (48 females; M_{age} = 23.69 years, SD_{age} = 5.9 years, range = 18–66 years).

Materials. Our primary stimuli consisted of five paragraphs that mirrored the "leads" of a typical news story (first paragraph of a news story that summarizes its content). Our news story described an event that generated political controversy (see Table 1). There were also seven distractor news stories about other issues such as news related to science. We constructed each news story such that the first few sentences provided background information about the event (e.g., A local museum is opening a new modern art exhibit. The exhibit will be open to all citizens for 2 months in the summer. The work of a local up and coming artist will be highlighted in the new exhibit. Some of the pieces in the exhibit contain nudity and strong suggestions of sexual activity). We refer to this part of the news story as the "context section." The specific topics for each story were chosen to allow us to feature highly salient, and thus well-differentiated, political positions on either side of the issue. This context section was then followed by two sentences that conveyed competing frames (the "frames" section). Following the example of Chong and Druckman (2007c, 2010), one frame was designed to elicit support for the political issue described in the news story (e.g., Free speech frame: Some comments have expressed support for the exhibit citing the importance of free

Table 1. Stimuli Used for the Study.

News story context	Frame 1	Frame 2
	Importance of free speech	*Respecting religious beliefs*
A local museum is opening a new modern art exhibit. The exhibit will be open to all citizens for 2 months in the summer. The work of a local up and coming artist will be highlighted in the new exhibit. Some of the pieces in the exhibit contain nudity and strong suggestions of sexual activity. The museum's board of directors has solicited feedback from the community regarding the new exhibit	Some comments have expressed support for the exhibit citing the importance of free speech considerations	Other comments point out that the exhibit offends their deeply held religious beliefs and should not be allowed in a public venue
	Minimum wage no longer a living wage	*Subsidizing less ambitious citizens*
Recently, Congress has been debating a newly proposed bill. The bill would primarily be focused on providing economic assistance to individuals and families who are below or near the federal poverty level. The bill would cost an estimated 10 billion dollars over the coming 6 years to fund. Congressional leaders have been holding a number of town hall meetings to gauge public sentiment toward the new piece of legislation	One sentiment shared is that minimum wage is no longer a living wage, so such a bill provides necessary aid	Another sentiment shared at the town hall meetings has been a concern over taxing prosperous citizens to subsidize less ambitious citizens
	Discriminating against different views	*Choosing between religious beliefs and livelihood*
A new bill is proposed in the state legislature and is currently being debated. This bill would allow businesses to decline providing services to customers if doing so would violate their deeply held religious beliefs. The bill stipulates that businesses would be protected from potential discrimination litigation in such cases. The bill is nearly identical to other bills that have already been enacted in a number of other states	Opponents of the bill have argued that it will allow businesses to discriminate against those who hold different lifestyles and views	Supporters of the bill have argued that without its protections, many business owners must choose between their religion and their livelihood

(continued)

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Table I. (continued)

News story context	Frame 1	Frame 2
A local organization has reserved the public outdoor amphitheater for a concert. The band they have booked for the concert is known for their strong political views and occasional use of explicit lyrics. The amphitheater is located in the center of the city park, and concerts can be seen and heard by those using the park. The organization has scheduled the concert for a Saturday afternoon in the summer	*Equality of views in public spaces* Some in the community think that a public space should be equally available to all citizens regardless of views	*Disturbing the peace* Others argue that the concert constitutes a disturbance of the peace and should be canceled due to its offensive nature
A large oil company is proposing to begin offshore drilling operations near a popular bay. The company believes there are large, untapped reserves of oil beneath the seafloor. An oil refinery employs many local residents. The proposed drilling operations would occur 10 miles offshore. The beaches around the bay are popular tourist destinations. Swimming, fishing, and boating are common in the bay, which is known for its seafood	*Harming the environment* Some in the community fear such drilling would be harmful to sea life and the local environment	*Discouraging future business opportunities* Other local residents think saying no will discourage other business opportunities in the future

speech considerations). The other frame was designed to elicit opposition to it (e.g., Respecting religious beliefs frame: Other comments point out that the exhibit offends their deeply held religious beliefs and should not be allowed in a public venue). These frames were chosen to represent ideologically opposing views toward the issue. To ensure that this was in fact the case, we pretested the frames using a different group of participants and confirmed that one frame for each story was perceived as aligning with conservative views, while the other was perceived as associated with a liberal ideology.[4]

The two competing frames were always placed at the end of the news story, and the order of the frames (whether the frame was meant to elicit support or opposition was presented first) was counterbalanced across participants. All news stories were between 100 and 111 words long. The sentences containing the frames were between 14 and 22 words long.

Procedure. We used the serial reproduction paradigm to investigate how person-to-person retellings may change the number of frames people are exposed to in the information environment. This paradigm was developed by Bartlett (1932) and is one of the most prominent methods for examining the critical role of memory in determining how information is passed from person to person. It resembles the children's game of "telephone" in which a short phrase is whispered into the ear of another child, and thus passed down a line of people. The serial reproduction paradigm operates in a similar manner by employing "chains" of individuals tasked with retelling the stimuli from memory. The method has been used to examine the role of memory in social transmission for a variety of social phenomena such as the transmission of rumors (Allport & Postman, 1947), stereotypes (Kashima, 2000; Lyons & Kashima, 2003), and cultural practices (Mesoudi, 2007; Mesoudi & Whiten, 2008).

Participants were tested individually in a quiet room. Participants were instructed at the start of the study that they would be reading several news stories. Participants were told that each news story would be on the screen for 30 seconds, after which the screen would be replaced by an empty text-entry box in which they would be asked to reproduce verbatim, from memory, the news story they had just read. The participants were given as much time as they needed to reproduce the news stories from memory. Participants read 12 news stories (five were our critical stimuli, seven distractor news stories) and generated reproductions for all of them. The order of the news stories was randomized across participants.

This main task was completed using either a laptop or smartphone for a given news story. We had participants complete the task using both laptops and smartphones to reflect real-world social transmission which can occur across various digital devices. During the experiment, participants completed half of the main task on the laptop and the other half on the smartphone. Order of device as well as which news stories were displayed on each device were both counterbalanced across participants. The smartphones had the auto-correct and auto-complete functions turned off so that they did not provide a benefit in typing speed or by suggesting subsequent words. As we used a web-based application, laptops did not provide a spell-checking function either.

Participants were instructed to use the devices as they were presented and not to change any settings.

The design employed the serial reproduction paradigm. Participants were randomly assigned to a position in one of 32 three-person chains (see Figure 1A). We use a "wave" terminology to refer to each position in the chains: The first position is "Wave 1," the second position is "Wave 2," and the third position is "Wave 3." Participants in Wave 1 were exposed to the original versions of our critical stimuli (Table 1). That is, all participants were shown news stories containing two competing frames. Critically, the reproductions of the Wave 1 participants were used as the stimuli for participants in Wave 2. Then, the reproductions of the participants in Wave 2 were used as stimuli for the Wave 3 participants. We told participants that the stimuli were news stories posted on social media to reduce any suspicion caused by misspellings, poor grammar, or other peculiarities in the reproductions.

Content analysis of the reproductions. Each reproduction was coded for the presence of the two frames in the original news story post. A frame was coded as present if the reproduction contained exact or semantically/conceptually related ideas to the original version of our frames. For example, given the original frame "some comments have expressed support for the exhibit citing the importance of free speech considerations," a reproduction that mentions "first amendment rights" instead of "free speech considerations" would be classified as containing the original frame. All reproductions were coded independently by two research assistants blind to the aims of the study. Intercoder reliability was assessed using Krippendorff's alpha, and there was a high level of agreement between the coders (α = .81). There were 88 instances (out of 960 observations) in which the coders disagreed. For these 88 cases, the coders then had a discussion to resolve their disagreements, which resulted in the creation of the final data set.

Results

First, we tested Hypothesis 1: As the number of retellings increases over the course of person-to-person communication, the number of frames within a given retelling will decrease. If an increase in the number of retellings causes a decrease in frames, then we expect the total number of frames in the news story reproductions to be greater in Wave 1 than Wave 3. To test this possibility, we estimated a mixed-effects regression model. We included wave (coded Wave 1 = "0," Wave 2 = "1," Wave 3 = "2") as a fixed effect and as our primary independent variable. Our primary dependent variable was the total number of frames (maximum of two) for each of the five news stories for a given participant. A negative and significant coefficient (B = −0.21, SE = 0.06, $p < .01$) suggests that reproductions in Wave 1 were more likely to contain a greater number of frames than reproductions in Wave 3—supporting Hypothesis 1 (Table 2, Model 1).

Indeed, as can be seen in Figure 2A, 50% of the reproductions in Wave 1 contained two frames, 34% contained one frame, and 16% contained zero frames. By Wave 2,
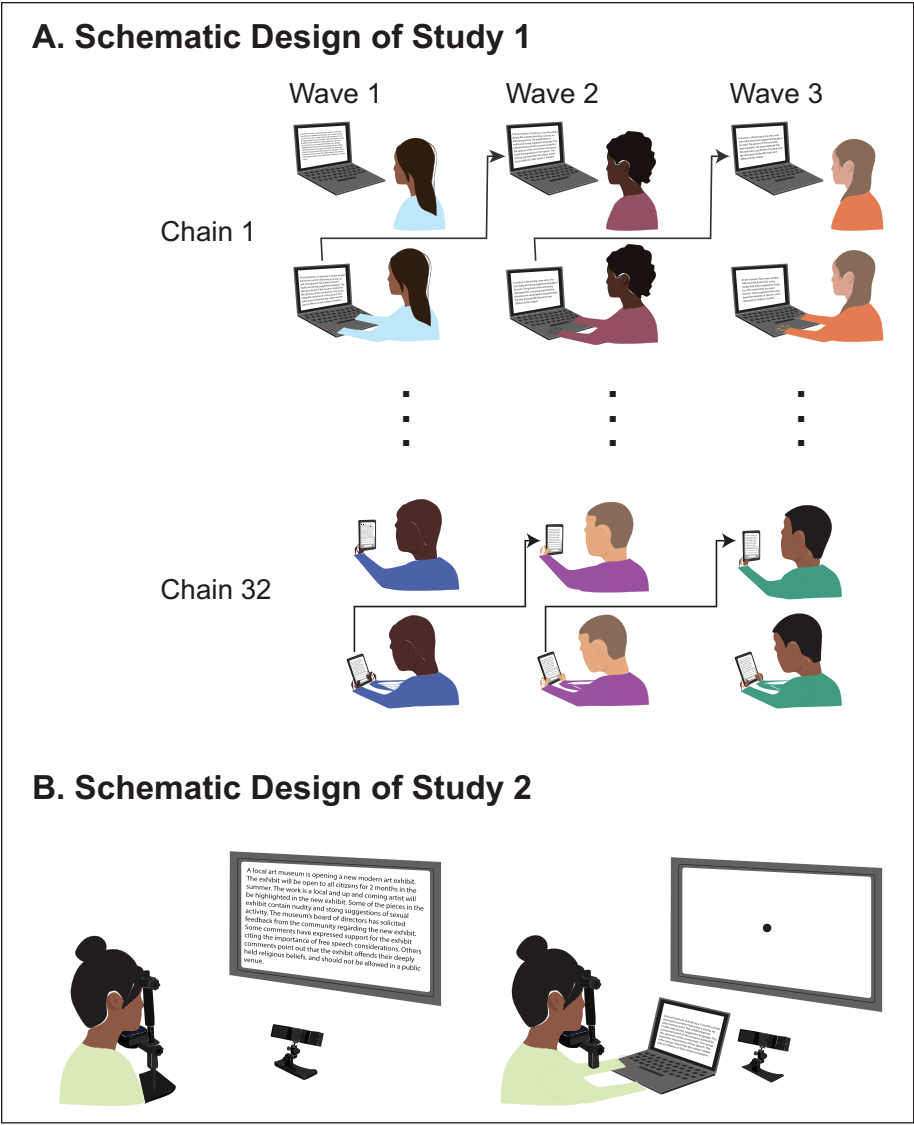
Figure 1. Schematic design of (A) Study 1 which employed the serial reproduction paradigm and (B) Study 2 which used eye movement monitoring.

31% of the reproductions contained two frames, 41% contained one frame, and 28% contained zero frames. Finally, by Wave 3, 22% of the reproductions contained two frames, 48% contained one frame, and 30% contained zero frames. Thus, by Wave 3, close to half of the news story reproductions contained only a single frame. What was once an information environment with competing frames (Wave 1) was turned into a
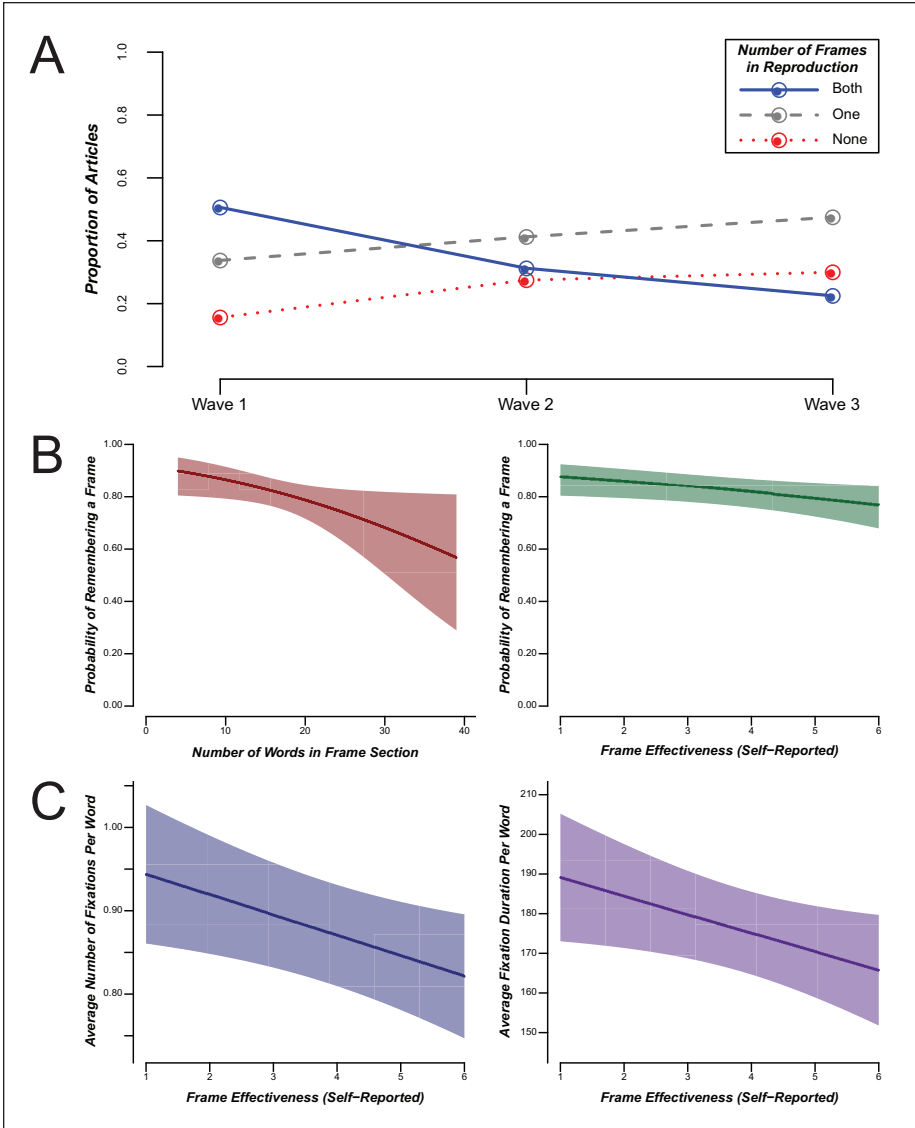
Figure 2. (A) Proportion of reproductions with either 0, 1, or 2 frames across the three waves. The proportion values for each wave sum to 100%. In Wave 1, 50% of reproductions contained two frames and 34% one frame. By Wave 3, 22% of the reproductions contained two frames and 48% contained one frame. (B) Predicted probability plots showing (1) as number of words in frame section increases, the probability of remembering a frame decreases, and (2) as rating of the frame's effectiveness increases, the probability of remembering a frame decreases. (C) Plots showing that as rating of the frame's effectiveness increases, the average number of fixations and fixation durations to words that comprise the frame decreases (decrease in attention). Shaded regions represent 95% confidence intervals.

framing environment with one frame (Wave 3; see Table 3 for an example of how the reproductions changed over the course of person-to-person transmission).

Next, we tested Hypothesis 2: As message length decreases, people will be more likely to remember frames. To test this hypothesis, we only analyzed data for a given trial (i.e., unique participant and news story combination) if the news story that a participant was exposed to contained at least one frame. For example, all trials for Wave 1 were included in this analysis given that all 32 participants were exposed to the original versions of the news stories. A participant in Wave 2, however, may have been exposed to a news story reproduction that contained only one frame and another news story reproduction that contained zero frames. In this example, only the trial in which the participant was exposed to the reproduction containing one frame was included in the analysis. We instituted this inclusion/exclusion criterion because memory performance for frames cannot be assessed for information to which participants were not exposed.

Similar to previous serial reproduction studies, we obtained natural variation in message length in people's reproductions. Previous studies have documented that people's reproductions become more "gist like" in that they contain fewer words and less extraneous details, and tend to focus more on the "core" idea in the message over the course of serial reproduction (Allport & Postman, 1947; Bangerter, 2000; Bartlett, 1932; Carlson, 2017). We replicate this result; the number of words contained in the messages decreased in successive reproductions (see Figure 2B). For example, our original news stories had an average of 18.9 words ($SD = 2.72$) for the frames section. The frames section of the reproductions decreased over the waves ($B = -1.47$, $SE = 0.62$, $p = .02$)[5] and contained an average of 11.7 words ($SD = 5.3$) in Wave 1, 9.24 words ($SD = 4.18$) in Wave 2, and 8.41 words ($SD = 3.86$) in Wave 3.

To test Hypothesis 2, we estimated a logistic mixed-effects model in which we modeled the number of words in the frames section that people were exposed to as a fixed effect and our primary independent variable. We also included wave as a covariate to account for other message features that may have changed across the waves. Our dependent variable was whether a frame a participant was exposed to appeared in his or her memory-based reproduction of the news story (0 = did not appear, 1 = did appear). A negative and significant effect of word count ($B = -0.05$, $SE = 0.02$, $p < .05$) suggests that as the number of words increased for the frames section, people were less likely to remember the frames (Table 2, Model 2; Figure 2B).[6] The results suggest that frames that contain fewer words are more likely to be remembered.

Investigating an alternative explanation. We now consider an alternative explanation that may account for why individuals reproduce fewer than two frames. One explanation is that individuals do remember the two competing frames, but they choose to only reproduce the frame that is congruent with their preexisting beliefs. Under this *strategic transmission account*, individuals choose to only transmit frames that they find convincing or persuasive.

Our design allows us to test this possibility. After completing the reproduction task, participants were shown all the original versions of the news stories and frames (even

Table 2. Results for Study 1 and Study 2.

Independent Variables	Study 1			Study 2		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Number of frames reproduced (regardless of exposure)	Given exposure to frame, whether frame is reproduced	Given exposure to frame, whether frame is reproduced	Average number of fixations per word comprising frame	Average fixation duration per word comprising frame	Whether frame is reproduced
Wave	−0.21** (0.06)	0.60** (0.23)				
Message length (frame)		−0.05* (0.02)				
Frame effectiveness (self-reported)			−0.15* (0.07)	−0.02* (0.01)	−4.70* (2.20)	0.07 (0.07)

Note. Mixed-effects regression coefficients are shown with standard errors in parentheses for Models 1, 4, and 5. Mixed-effects logistic regression coefficients are shown for Models 2, 3, and 6. For the dependent variable in Models 2, 3, and 6, frame is reproduced = 1 and frame is not reproduced = 0.
*$p < .05$. **$p < .01$.

participants in Waves 2 and 3 were shown the original frames). Participants were then asked to rate the effectiveness of the argument conveyed in the frame (1 = definitely not effective, 6 = definitely effective). Participant's individual ratings of a frame's effectiveness are useful because (1) they provide people's specific assessments/beliefs about each frame and (2) there is evidence that they reflect participants' general preexisting attitudes. Specifically, frames that are ideologically incongruent with the participants' general ideological beliefs (e.g., frame associated with conservative ideology shown to a liberal participant) were rated as less effective than ideologically congruent frames (see Supplemental Material).

We estimated a mixed-effects regression model in which we used participants' effectiveness ratings of the frames as an independent variable. Our dependent variable was whether a frame a participant was exposed to appeared in his or her reproduction of the news story (0 = did not appear, 1 = did appear). A positive coefficient would suggest that participants were more likely to reproduce frames they perceived as more effective—a result consistent with the alternative explanation that individuals only transmit frames that support their preexisting attitudes.

In contrast to the prediction of a strategic transmission account, we found a significant and negative coefficient ($B = −0.15$, $SE = 0.07$, $p < .05$) for the effectiveness ratings. This outcome suggests that frames that were perceived as least effective were more likely to be reproduced (see Table 2, Model 3; Figure 2B).[7] One possible explanation for this result is that frames that individuals remember were ones in which they engaged in counterarguing (Taber & Lodge, 2006). Counterarguing, or the generation

Table 3. Examples of Participants' Reproductions Across Three Chains.

Waves	Chain with two frames remaining by Wave 3	Chain with one frame remaining by Wave 3	Chain with zero frames remaining by Wave 3
Wave 1 reproduction	There is a new art gallery opening up that will be featuring artwork of an up & coming artist. This art depicts nudity with a strong hint of sexual activitiy. Some believe that this should not be allowed to be shown in the gallery due to their religious beliefs. Others believe that due to free speech, it should be shown in the gallery	A local museum will be opening up an exhibit that will be open to all citizens for 2 months in the summer. The exhibit will show art from a local artist. The exhibit will contain nudity and strong sexual suggestions. Some people say that this is ok. others suggest that the exhibit should not occur because it offends their deeply held religious beliefs	A local museum is currently opening a new modern art exhibit. The exhibit will be open for two months over this summer. Some comments express the support of the exhibit citing the importance of free speech. Other comments are against the exhibit.
Wave 2 reproduction	There is a new art gallery opening up that will feature work from a new up and coming artist. This artists work features nudity with a strong hint of sexuality. Many do not believe this artwork should be shown due to religious reasons. others feel it should be shown due to free speech	A local museum will be opening up a new exhibit to all citizens for 2 months in the summer. The exhibit will contain nudity and strong sexual content. Some say this exhibit will be a good thing. Others say that its content will offend their deep religious beliefs	A local museam is opening a modern art exibit. The exibit will be open for two months over the summer. Support for the museam saying it is a exercise in free speech. While others are against the exibit.
Wave 3 reproduction	A new gallery is opening up featuring an up and coming new artist. The art consists of nudes with a strong hint of sexuality. Some reject the art due to religious reasons. others believe it should be shown to free speech	A local musuem is opening up a new exhibit to all citizens for 2 months in the summer. The exhibit will contain nudity and strong sexual content. Some say that the exhibit will be a good thing. Others say that the exhibit will offend their deep religious beliefs	a musuem is opening a local art exhibit. it will be open for two months in the summer

Note. Misspellings are original to the participants' reproductions.

of arguments to challenge incoming information, can lead to greater elaboration and attention to the frames and better memory for it (Jain & Maheswaran, 2000; Taber & Lodge, 2006). Another explanation is that frames that are counter-attitudinal are less likely to be encountered by individuals in their everyday lives and thus are more novel and memorable. Regardless of the reason, this result is inconsistent with the alternative explanation that individuals remember both frames but choose to only reproduce ones that support their preexisting attitudes.

Discussion

We found support for Hypothesis 1: As the number of retellings increases over the course of person-to-person communication, the number of frames within a given retelling will decrease. We found that 50% of the reproductions in Wave 1 contained two competing frames and 34% contained one frame. However, by Wave 3, 22% of the reproductions contained two frames, and 48% contained only one frame. Thus, although the information environment was one that initially contained competitive frames (i.e., all individuals in Wave 1 were exposed to competitive frames), person-to-person retellings changed an environment that contained multiple frames into one that contained only a single frame. We also obtained support for Hypothesis 2: As message length decreases, people will be more likely to remember frames. Finally, our exploratory analyses also revealed that as perceived effectiveness of frames decreased, individuals were also more likely to remember them.

Our study advances the framing literature in several ways. First, despite the ubiquity of person-to-person communication, much of the literature on competitive framing has not considered how frames are transformed as they are retold across individuals. Our study represents one of the early attempts at studying this issue. Second, our findings indicate that a framing environment, though initially static in terms of the number of frames, may not remain so once social transmission begins. Thus, while research has examined the effects of either a single or competitive framing environment, it is likely that real-world framing environments are much more fluid. Furthermore, the specific finding from this study is that competitively framed environments can reduce to single frame environments. This suggests that there may be downstream framing effects that are quite different than those experienced by the person exposed to the initial message.

Third, our finding that message length influenced people's ability to remember frames has implications for future studies examining media channels that vary either in the limitations they impose on message length or their tendency to foster certain habits in message construction (Twitter, texting via smartphone, email). For example, Facebook currently does not limit the number of words in their posts, while Twitter has a character limit for tweets (Waterloo et al., 2018). Text-messaging via smartphone also tends to foster shorter messages compared with other electronic mediums (Choudhury et al., 2007). Of interest is how such factors may influence the likelihood that people are able to remember frames, which in turn influences their likelihood of conveying the frames to another person. Our study suggests that frames conveyed in

media channels that foster shorter messages (Twitter, texting via smartphone) might be more successful at increasing people's ability to remember frames.

Furthermore, our finding that text-based messages become gist-like, or shorter, over the course of serial reproduction and, as a consequence, become easier to remember opens the possibility that the number of frames in serial communication chains may "stabilize" in later reproductions. That is, the rate in which frames disappear in subsequent message reproductions may stop or drastically slow down, thus maintaining a single framing environment (i.e., the framing environment will not entirely drop to zero frames). Future work can explore this possibility by examining more waves in the communication chains.

Finally, the finding that as perceived effectiveness of frames decreased, individuals were also more likely to remember them raises the possibility that individuals were more likely to direct attention to frames that oppose rather than support their preexisting attitudes. As our design in Study 1 did not allow us to directly measure attention in real time, we cannot speak to the specific role of attention in competitive framing environments. This is an important topic to investigate given theoretical work on framing effects assumes that individuals must first pay attention to frames in order for the frames to exert effects on attitudes and behaviors (for a review, see Chong & Druckman, 2007b). We are unaware of any extant studies that have measured attention to competitive frames in real time using eye-tracking methods. Thus, Study 2 attempts to address this gap in the literature as well as this limitation of Study 1.

Study 2

In Study 2, we conduct exploratory analyses to examine whether individuals are more likely to direct attention to frames that oppose or support their preexisting beliefs. Increased attention directed to frames perceived as less effective could be because such frames were ones that individuals counterargued against. That is, viewing frames that challenge their existing beliefs may have caused individuals to generate arguments to refute this opposing position, and thereby justify their existing beliefs. If so, greater elaboration on the frames will be associated with higher levels of visual attention. Another possibility is that counter-attitudinal frames are ones that individuals are less likely to encounter in their everyday lives. Research shows that people direct greater attention to information that is more novel than familiar (Bradley, 2009). Study 1 is unable to parse apart these two potential explanations, and it is also possible that both may occur to some degree at the same time. In any case, greater attention paid to arguments perceived as less effective has important implications. Selective attention has been the focus of much debate, with some research suggesting that individuals pay greater attention to belief-consistent information (Graf & Aday, 2008). Meanwhile, alternative evidence points to a disconfirmation bias that aligns with the explanations for greater attention toward counter-attitudinal information laid out above (Edwards & Smith, 1996; Taber & Lodge, 2006). Testing the specific role of attention in our findings will help to inform the study of selective attention in the context of competitively framed information environments.

In Study 2, we showed individuals the same original news stories with competing frames used in Study 1. After reading each news story, participants were asked to reproduce from memory the news story. After completing the reproduction task, and similar to Study 1, participants were shown all the original news stories again and asked to rate each frame in terms of their effectiveness.

We used eye movement monitoring technology to measure, in real time, the amount of attention that people direct to the two frames. The monitoring of eye movements provides two unique advantages. First, eye movement monitoring technology allowed us to assess people's attention to information at the moment of exposure (as they were reading the news stories). Second, eye movements can provide researchers with unique information about what features of a person's visual field (e.g., specific parts of a news story) are at the focus of attention. This feature of eye movements is important because people are often unaware of when they make eye movements and the location of their gaze while looking at information in their visual field (Spering & Carrasco, 2015). This limits their ability to self-report this information. We use eye-tracking technology to examine whether participants direct greater levels of attention to frames that oppose rather than support their preexisting attitudes.

Method

Participants. We recruited a total of 70 participants from a large Midwestern University and the surrounding community in the United States. All participants were compensated with US$15 for taking part in the study. We excluded six participants who were wearing glasses or contact lenses that interfered with the calibration of our eye-tracking instruments. We analyzed data from the remaining 64 participants (31 females; M_{age} = 25.70 years, SD_{age} = 4.91 years, range = 18–46 years).

Materials. Our primary stimuli consisted of the same five news stories used in Study 1 (see Table 1). We also used the same seven distractor news stories from Study 1 to help conceal the true purpose of the study.

Procedure. Participants were tested individually in a quiet room where they were seated 100 cm away from a 24-inch LCD monitor (resolution 1920 × 1080) with a refresh rate of 60 Hz. Before the experiment began, the desktop-mounted SR Research EyeLink 1000 eye tracker was fitted and calibrated for each subject with a 9-point calibration system. A rigid mount was used to keep the chin and forehead from moving.

Participants were told that each news story would be on the screen for 30 seconds. After reading each news story, participants were provided a laptop. The laptop screen displayed an empty text-entry box in which participants were asked to reproduce verbatim, from memory, the news story they just read (see Figure 1B). The participants were given as much time as they needed to reproduce the news stories from memory. Participants read 12 news stories (five were our critical stimuli, seven distractor news stories) and generated reproductions for all of them. The order of the news stories was randomized across participants.

Content analysis of the reproductions. Each reproduction was coded for the presence of the two frames in the original news story post. We used the same coding rules as Study 1. All reproductions were coded independently by two research assistants blind to the aims of the study. Krippendorff's alpha revealed adequate reliability ($\alpha = .76$), and there were 60 instances (out of 640 observations) in which the coders disagreed. For these 60 cases, the coders had a discussion to resolve their disagreements, which resulted in the creation of the final data set.

Results

We defined areas of interest around words that comprised the two frames. We operationalized gaze as the number of fixations (discrete pauses of the eyes) and duration of these fixations directed to a given area of interest. The function of fixations is to place information within our foveal vision (the center of our gaze) where visual acuity is the highest (Rayner, 1998). We then calculated average number of fixations and average duration of fixations directed to the words that comprised the frames. These were our dependent variables. An increase in the number of fixations and fixation duration indicates greater levels of attention directed to an area of interest (Rayner, 1998). We then estimated two regression models in which we used participants' effectiveness ratings of the frames as an independent variable.

We found significant and negative coefficients: Participants were less likely to direct greater fixations ($B = -0.02$, $SE = 0.01$, $p = .02$) and fixation durations ($B = -4.7$, $SE = 2.2$, $p = .03$) to frames that they rated as effective (Table 2, Models 4 and 5; Figure 2C). These results suggest that participants were more likely to direct attention to frames that they rated as less effective than ones they considered to be effective.

We also estimated a separate model in which we used the effectiveness ratings of the frames as the independent variable, and our dependent variable was the extent to which a given frame appeared in the participant's reproduction of the news story ($0 =$ did not appear, $1 =$ did appear). There was no significant effect of ratings of frame effectiveness on memory for frames (Table 2, Model 6).

Discussion

We found support for the notion that individuals were more likely to direct attention to less effective than effective frames. As mentioned previously, this increased attention associated with less effective frames could be because such frames were ones that individuals counterargued against, because they were more novel, or both. There is prior evidence to suggest that individuals do often counterargue attitudinally incongruent arguments for political topics (Edwards & Smith, 1996; Taber & Lodge, 2006). If such a disconfirmation bias is in fact at play, greater elaboration of the frames would be associated with higher levels of visual attention, the same pattern found here. While we cannot ultimately rule out the role of novelty in influencing greater attention allocation toward counter-attitudinal frames, it may also be the case that such processes are relatively intertwined when it comes to salient political topics.

Unlike Study 1, we did not find the association between effectiveness ratings and memory for frames. This could be because many of the frames in Waves 2 and 3 of Study 1 were also shorter than the original versions, whereas Study 2 used the original frames exclusively. The shorter frames in Study 1 may have increased people's ability to remember the least effective frames. Nevertheless, the eye movement results support the idea that individuals do not always direct greater attention to frames that comport with their beliefs.

General Discussion

Much of the current experimental research on framing has not examined how frames can be changed over the course of person-to-person communication. We reasoned that although a person may have been exposed to multiple competing frames about a political issue, they may only convey one frame when discussing the issue with someone else. In Study 1, we examined the critical role of memory in determining the extent to which a given frame is retold to another person. We found that the process of forgetting in combination with the process of person-to-person communication turned an information environment largely dominated by competing frames into a single framing environment. Our study represents one of the early attempts at examining how frames are transformed as they are retold from person to person. This is an important contribution given that individuals often retell political information to friends, family members, colleagues, and so on, who, in turn, can retell it to others. In addition, previous work has shown that the number of frames that people are exposed to can determine the strength of framing effects.

In Study 1, we also observed that the descriptions of the messages became more gist-like in that the number of words used to convey both the background context and the frames decreased through successive reproductions. One consequence of this transformation is that the frames became easier to remember as the number of words decreased. This finding suggests the intriguing possibility, which future work can explore, that frames conveyed in media channels that foster shorter messages (Twitter, texting via smartphone) may be more successful at increasing people's ability to remember frames.

In Study 2, we sought to address a limitation of Study 1 as well as a gap in the literature regarding the role of attention toward competing frames. We found that individuals were more likely to direct attention to frames that they rated as less effective. This evidence aligns with the idea that individuals are more likely to counterargue attitudinally incongruent information. Indeed, research has previously demonstrated a similar disconfirmation bias, such that attitudinally incongruent messages are scrutinized longer, rated as weaker, and led to increased counterargument production (Edwards & Smith, 1996; Taber & Lodge, 2006). Study 2 not only supports these prior findings but more directly assesses attention and also extends these findings in regard to competitive framing environments. Previous research into disconfirmation bias effects has generally investigated evaluations of either attitudinally congruent or incongruent frames in isolation. Given that individuals are likely to encounter situations where

both sides of an issue are presented in close proximity (e.g., news stories, social media feeds, comment boards), our findings are important for understanding how attention may be allocated in such settings.

Furthermore, the relationship between effectiveness ratings and frame memory was not observed in Study 2. Given that Study 1 found these effects in the presence of social transmission, it seems likely that the more gist-like frames transmitted in Waves 2 and 3 likely amplified the relationship between frame ratings and memory. Thus, it is possible that social transmission of competitively framed topics has significant downstream effects on how such information is remembered and presented to others.

Like all work, however, our studies have limitations, and caution is warranted in terms of generalizing some of the results. The serial reproduction paradigm we used here does not reflect all the complexities involved in real-world social transmission. For example, individuals often have the opportunity to learn about news from multiple sources, are not limited in time to interact with a news source, and may be prompted for additional information during discussion with others. Sociological framing research has pointed to a variety of social factors that affect how frames are transformed through interpersonal discussion (Gamson, 1992; Walsh, 2004). We used the serial reproduction paradigm to look specifically at the critical role of memory for frames. Memory is an important component of social transmission because individuals cannot transmit information to others if they do not possess memory of that information. Although we prioritized internal over external validity, the serial reproduction paradigm can be adapted to reflect elements of real-world social transmission (e.g., two-way discussion, receiving information from multiple partners, and evaluating information from a friend vs. a stranger; for a review and examples, see Mesoudi & Whiten, 2008), which future work can explore.

In addition, we focused specifically on the social transmission of competing frames that were equally presented. Given the increasing number of partisan media options, exposure to frames may not always begin in such an equitable manner. Furthermore, individuals tend to associate with close others who are likely to share their political and social identity, which may influence how frames are transformed (Walsh, 2004). Research on political discussion has shown that normative pressures, in addition to information from opinion leaders, often shape collective action frames as they are transmitted among homogeneous communities (Gamson, 1992). Thus, it would be worth investigating if the effects found for competing frames in this study are replicated when the frames presented are less equivalent.

We also investigated frames conveyed solely via text. There is emerging work in the framing literature examining multimodal frames via the combination of text and images (Powell et al., 2018, 2019). Given evidence that individuals are more likely to direct attention and remember images than text (Higgins et al., 2014), future work should examine the extent to which the results we observe here generalize to multimodal framing environments.

Our participants also reconstructed the messages from memory a few minutes after exposure to them. In some real-world contexts, individuals may not need to access information from memory about messages for days or months after exposure to them.

Existing work suggests that individual differences can determine whether framing effects will endure weeks or months after exposure (Lecheler & de Vreese, 2011; Matthes & Schemer, 2012). Although we did not examine the extent to which these reproductions could elicit framing effects, our theoretical framework would predict that differences in people's capacity to remember frames across time may, in part, account for differences in the durability of framing effects.

In addition, most individuals in our sample have received or are currently receiving a college education. Thus, individuals in our study are likely better educated than individuals from a representative sample (although work in political communication suggests that generalizing from nonrepresentative samples may be warranted under certain conditions; Druckman & Kam, 2011).

Finally, we exposed individuals to a specific news story only once. In real-world information environments, individuals can be exposed to news stories multiple times. Such repeated exposure may improve their ability to remember frames. Although we focus on emphasis frames in this study, future work should also examine the extent to which our results generalize to equivalency frames. Despite these limitations, however, our studies provide the theoretical and methodological foundations that future research can build on.

Indeed, our studies further illustrate the value of a multimethod approach. We used the serial reproduction paradigm, along with a content analysis of people's reproductions, to examine the roles of person-to-person communication in transforming frames and message length on people's ability to remember frames. We then used eye movement monitoring to gain unique leverage on attentional mechanisms underlying why some people may forget frames. This combination of distinct approaches allowed us to uncover the important theoretical roles of attention, memory, and person-to-person transmission of information in how people transform frames when they convey them to others. Our focus on uncovering both cognitive and social mechanisms is important given Cacciatore et al.'s (2016) observation that "Although framing studies have exploded in recent years, the exact process behind the phenomenon remains a contentious issue, and one for which only a limited amount of research exists" (p. 15). Our studies answer this call for greater examination of the mechanisms underlying how people evaluate frames.

In summary, much of the previous literature on framing has not considered the important role of person-to-person transmission. Our studies suggest that person-to-person communication can profoundly change the content and number of frames present in the information environment. Furthermore, the research presented here has begun to identify the conditions under which people are likely to direct attention to frames and the mechanisms that facilitate or impair people's ability to remember them. This connection between micro- (i.e., cognitive) and macro-level (i.e., person-to-person communication) processes undoubtedly shapes both what information people encounter and how they interpret that information. Thus, future work on framing must address how cognitive mechanisms and communication environments interact to influence the effects of frames on attitudes and behaviors.

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Supplemental Material

Supplemental material for this article is available online.

Notes

1. We recognize that there are many different conceptualizations of "framing effects" (Scheufele, 1999; Tewksbury & Scheufele, 2009), but we are specifically referring to the conceptualization predominantly used in experimental work on framing.
2. This is distinct from "frames in thought" which refers to an individual's cognitive understanding of an issue or political event (Chong & Druckman, 2007c).
3. The few experimental studies that have examined framing in the context of interpersonal communication have not examined how the frames have been transformed by individuals (Druckman et al., 2018; Druckman & Nelson, 2003).
4. We selected these stimuli based on pretests in which we recruited 100 participants from Amazon's Mechanical Turk.
5. This was estimated using a regression model with wave as an independent variable. Word count of the frame reproduction was used as the dependent variable.
6. In terms of the magnitude of the effects, as the number of words comprising the frames rises from its lowest (four words) to highest value (39 words) in our sample, the predicted probability of remembering the frame drops from 90% to 57%.
7. See Supplemental Material for additional convergent analysis that involves interacting participant's ideology and ideological association of the frame.

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