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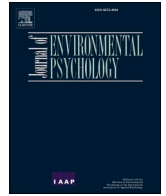
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A large-scale study of binding communication to promote ecological Behavior: the commitment technique combined with persuasive communication in mass media streaming

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ABSTRACT

The climate emergency necessitates the adoption of effective communication strategies. While persuasive communication is easily scalable, its effectiveness at changing behavior is limited. In contrast, commitment techniques, such as foot-in-the-door and low-ball techniques, are more effective for behavior change but harder to scale. In this study, we test the effectiveness of combining a commitment strategy with persuasive communication in the streaming broadcast of an audiovisual show. Study 1, conducted in an “as if” setting with a full experimental design ($N = 1003$), showed that incorporating a commitment strategy into persuasive communication effectively promoted pro-ecological behavior, although it did not lead to a significant change in attitudes. In Study 2, conducted in an ecological setting during a live broadcast of an international rugby tournament ($N = 240,245$), we showed that combining commitment and persuasive strategies increased the intention to engage in behaviors that reduce digital pollution.

1. Introduction

Many scientific reports on climate change emphasize the need for urgent changes in individual behavior to protect our environment. Public policies aim to promote these changes through mass communication campaigns, particularly via televised advertising, to encourage environmentally responsible behavior. While mass communication is an essential way to reach a large audience, designing effective public policies to address ecological issues remains a major challenge, particularly for the psychological sciences. The difficulties involve both attitudes change in individuals (e.g., Steinmetz et al., 2016) and the transformation of behavioral intention into action for those who already hold favorable attitudes towards ecological behavior (e.g., van Doorn et al., 2007; Zhang et al., 2023). Historically, these issues echo two influential theoretical fields: on the one hand, the persuasion field concerning the change in attitude (Briñol & Petty, 2012; Kruglanski & Thompson, 1999) and on the other hand, the commitment field (Kiesler, 1971; Lokhorst et al., 2013) when interventions focus directly on behavior. Over the past decade, researchers have proposed combining persuasive communication with commitment techniques (i.e., binding communication,

Joule et al., 2007). This approach is believed to enhance both behavioral change (e.g., Rubens et al., 2011) and attitude change (e.g., Michelik et al., 2012). However, studies on binding communication remain scarce and limited in terms of methodology and application. Notably, existing research is often limited by small sample sizes and incomplete experimental designs, which prevent drawing rigorous conclusions about the effectiveness of binding communication. Moreover, no study to date has explored the integration of binding communication into mass media platforms, such as audiovisual broadcasting. Yet, tackling global ecological challenges requires optimizing the balance between strategy effectiveness and scalability for mass dissemination. To address these limitations, we conducted two complementary studies with large sample sizes (Study 1, $N = 1003$; Study 2, $N = 240,245$). The first study, conducted in a laboratory setting, aimed to overcome methodological limitations present in prior research on binding communication. The second study, conducted in a real-world ecological context, complemented the first. Notably, these two studies are, to our knowledge, the first to test the effectiveness of commitment techniques in the context of mass audiovisual broadcasting to encourage pro-environmental behavior. Given the urgency of ecological challenges, it is crucial to explore scalable

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strategies that can effectively reach a large and diverse audience.

2. Persuasive communication

Persuasive communication aims to modify individuals' mental states (e.g., attitudes, intentions) towards a behavior in the direction desired by the message (Petty & Briñol, 2012; Petty & Cacioppo, 1984). Given the ease of their dissemination, persuasive communications have established themselves as the preferred strategy in mass communication contexts (Ejupi et al., 2014; Wartella & Middlestadt, 2012). Numerous studies have been conducted to understand the mechanisms and factors that modulate the effectiveness of persuasive communication (Albarracín & Vargas, 2010; Cacioppo et al., 1986; Chaiken & Ledgerwood, 2012). In a theoretical article, Pelletier and Sharp (2008) proposed an integration of various persuasive communication strategies aimed at promoting pro-environmental behaviors, emphasizing their effects on self-determined motivation. They identified three key phases in the behavior change process, each requiring a specific type of message. The first phase, referred to as problem detection, aims to draw the target's attention to environmental issues. In this phase, messages should emphasize the severity of the problem by employing strategies such as fear appeals or negative framing. These strategies, by eliciting a sense of threat (see Maddux & Rogers, 1983; Tannenbaum et al., 2015), are designed to increase motivation to act. In the context of encouraging ecological behavior, it has been shown that negatively framed messages focusing on losses tend to be more effective (Homar & Cvelbar, 2021; Gorissen et al., 2024). Similarly, moderate-intensity fear appeals have been found to more effectively facilitate the adoption of sustainable behaviors (Chen, 2016). The second phase, decision-making, involves individuals becoming receptive to messages that facilitate the initiation of action. At this stage, arguments should be framed positively, highlighting the personal or collective benefits of the proposed behavior, which promotes ownership and internalization of the targeted behaviors. Finally, the third phase corresponds to the implementation of the behavior. At this point, the most effective messages provide clear recommendations on what to do (goal intentions) and how to do it (implementation intentions). By helping individuals plan their actions, such messages strengthen the sense of self-efficacy and facilitate the long-term adoption of the behavior. In this regard, self-efficacy has been shown to enhance intention to engage in pro-environmental behavior (Choi & Hart, 2021) and to play a positive moderating role in the effectiveness of environmental communication strategies (Doherty & Webler, 2016). These findings align with a large body of psychological research suggesting that fear appeals tend to be more effective when they are accompanied by information that strengthens perceived self-efficacy (de Hoog et al., 2007; Tannenbaum et al., 2015).

While these techniques primarily concern the characteristics of persuasive messages, an approach focused solely on content is incomplete. For persuasive communication to be effective - particularly in mass media campaigns - it is also essential to consider recipient characteristics, such as motivation and cognitive resources. This insight is central to the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1984), one of the most influential frameworks in persuasion research. The ELM is a dual-process model in which individuals process persuasive messages through one of two distinct routes: a central route or a peripheral route. The central route involves deep cognitive processing of message content and is activated when motivation and cognitive capacity are high. In contrast, the peripheral route relies on heuristic cues, such as source attractiveness, source credibility, or the number of arguments presented (Cacioppo et al., 1986; Petty et al., 1994; Xiu et al., 2024), and is favored when either motivation or cognitive capacity is low. For instance, Manca and Fornara (2019), using an implicit measure of attitudes toward sustainable transportation, found that low-involvement individuals were more influenced by the perceived credibility of the source (e.g., a Nobel Prize winner), whereas highly involved individuals were more responsive to argument quality. In

addition to leveraging source-related heuristics, ecolabels have also been shown to function as effective heuristic cues for promoting pro-environmental behavior (Thøgersen, 2002). For instance, Sörqvist et al. (2015) demonstrated that a lamp labeled as "energy efficient" was more favorably perceived by users.

The theoretical framework provided by the ELM thus allows for tailoring persuasive strategies to both the characteristics of the audience and the context of message delivery. Furthermore, the ELM's dual applied and heuristic nature makes it particularly well-suited for designing messages intended for mass media dissemination, channels in which the audience's motivation to process the message is likely to be low (Petty et al., 2002). From this perspective, mass media appear to be preferred channels for the dissemination of persuasive communication. The link between persuasion and mass media is historically central to the development of these channels of information dissemination (see Bernays, 1928; Herman & Chomsky, 1988). In the field of psychological science, the use of persuasive strategies in mass media has given rise to both theoretical discussions (Petty et al., 2002) and numerous empirical studies, particularly regarding pro-environmental behaviors (Huang, 2016; Liao et al., 2016; Nisbet, 2009). For instance, a recent study by Dekoninck and Schmuck (2022), conducted on large-scale digital platforms, showed that following pro-environmental influencers increased users' pro-environmental intentions (see also Phua, Jin, Kim, & . (Jay), 2020). Similarly, Huang (2016) demonstrated that exposure to media messages about climate change directly influenced pro-environmental intentions, such as information-seeking, civic commitment, and daily practices.

To conclude, despite the interest in persuasive strategies, especially their application in mass media and in addressing ecological challenges, their impact on actual behavior remains debated (e.g., Joule et al., 2007). This controversy largely stems from the fact that such strategies primarily target behavioral antecedents, such as attitudes, whose relationship with real-world behavior can be relatively weak (e.g., the green gap; Sheeran & Webb, 2016). In response to this limitation, researchers have developed alternative approaches to strengthen the attitude-behavior link, notably by directly influencing behavior through techniques such as commitment strategies.

3. Commitment techniques

Commitment can be defined as the strength of the link between the individual and their behavior (Kiesler & Sakumura, 1966; Kiesler, 1971). The underlying assumption is that strengthening the link between individuals and their behavior increases the production of the expected behavior. In the same vein, the attitude strength construal (Fabrigar et al., 2019) echoes this pattern by proposing that activating the associative link between an object and its positive evaluation increases its accessibility and resistance to change (e.g., Bassili, 1996). For example, performing an initial, low-cost preparatory request such as sticking a small label related to road safety conditions increases the likelihood of accepting the target request, such as placing a sign in one's garden (Freedman & Fraser, 1966, Study 2). Commitment has thus mainly been operationalized through techniques aimed at increasing behavioral consistency, notably the foot-in-the-door (Burger, 1999; Freedman & Fraser, 1966) and low-ball techniques (Cialdini et al., 1978; Pascual et al., 2016).

The foot-in-the-door technique consists of getting people to perform a preparatory act prior to the target request. Because of the need for consistency, an individual performing the preparatory behavior is more likely to accept the target behavior (Guadagno et al., 2001). The low-ball technique involves obtaining commitment by gradually revealing the costs associated with the behavioral request or by withdrawing the advantage leading to an initial acceptance (Cialdini et al., 1978; Pascual et al., 2016). These two techniques, and commitment strategies more broadly, have proven their effectiveness in promoting many prosocial behaviors (e.g., organ donation, Carducci & Deuser, 1984; recycling,

Arbuthnot et al., 1976; Werner et al., 1995; smoking cessation, Guéguen, Silone, & David, 2016) and particularly pro-environmental ones (see Abrahamse et al., 2005; Demarque & Girandola, 2017; Lokhorst et al., 2013) in the context of the persistent “green gap” (e.g., Byfuglien et al., 2025; Carrus et al., 2021). More specifically, several studies have investigated the effectiveness of the commitment techniques presented above. Regarding the foot-in-the-door technique, Terrier and Marfaing (2015) showed that low-cost preparatory behavior (hanging a card on one’s hotel room door) promoted subsequent ecological behavior (reusing towels) more effectively than a purely persuasive message. As for the low-ball technique, Maksim and Śpiewak (2023) demonstrated its effectiveness in encouraging the adoption of pro-environmental behavior - choosing still water over carbonated drinks - a practice beneficial to both public health and environmental impact.

Furthermore, the interest in commitment techniques stems from their greater effectiveness in promoting behavior change, and sometimes even attitude change, compared to persuasive communication (e.g., Mickaël, 2014; Wang & Katzev, 1990). For instance, Mickaël (2014) demonstrated that the adoption of recycling behavior increased significantly over time following a commitment act (i.e., signing a recycling contract) rather than after receiving a persuasive message (i.e., a recycling guide). Similarly, with respect to attitudes, Michelik et al. (2012) found that performing a preparatory act resembling a foot-in-the-door technique - writing an essay in favor of recycling - was more effective in improving pro-recycling attitudes than simply reading a message outlining the environmental benefits of recycling. The greater effectiveness of commitment strategies, compared to persuasive strategies, may be accounted for by two main explanations. First, their effectiveness in fostering behavior change can be explained by the need for consistency, as conceptualized in cognitive dissonance theory (Festinger, 1957; Harmon-Jones, 2019). From this perspective, attitudes are more malleable than behaviors. Thus, engaging in a behavior consistent with the attitude tends to guide individuals toward subsequent consistent behaviors while also facilitating an alignment of their attitudes with the previously enacted behavior. Second, the commitment induced by fulfilling a preparatory request is likely to generate stronger active involvement than persuasive communication, in which the individual remains relatively passive (see Ingram & Geller, 1975; Witmer & Geller, 1976). Moreover, in a literature review conducted by Abrahamse et al. (2005), commitment stands out for its long-term effectiveness, which exceeds that of subsequent interventions (i.e., those implemented after the behavior, such as rewards), whose effects tend to diminish over time.

While commitment techniques often prove more effective than persuasive strategies in promoting behavior change, a third approach consists in combining the two to amplify their effects. Integrating commitment techniques into persuasive communication could thus form a more effective paradigm, referred to as binding communication.

4. Towards the use of binding communication in mass media

To enhance the efficacy of persuasive communication, the concept of binding communication, which combines a commitment technique with persuasion, has been proposed (Joule et al., 2007). Several studies have investigated binding communication in the context of prosocial behaviors (e.g., ecological issues, Terrier & Marfaing, 2015; blood donation, Fonte et al., 2017; road safety, Tamisier, Ragot-Court, Eyssartier, & Girandola, 2019). These studies reported greater effects on behavior (e.g., Terrier & Marfaing, 2015) and attitudes (e.g., Michelik et al., 2012) for binding communication than for persuasive communication alone. More specifically, binding communication has already been successfully applied in the context of promoting pro-environmental behaviors. For example, in the study by Demarque et al. (2013), participants were assigned to one of three conditions: a persuasive condition, in which they read a brochure about the negative consequences of human activities on the environment; a binding communication condition, in which

the reading of the same brochure was preceded by a commitment act consisting of creating a slogan for a sustainability-related institution; and a control condition, with neither persuasive communication nor a commitment act. The results showed that participants in the binding communication condition were significantly more likely to accept the target request (i.e., to staff a pro-environmental stand and dedicate time to it) than those in the persuasive or control conditions.

Nevertheless, a number of methodological limitations remain in the existing studies (see Table 1). One major limitation is the frequent use of small sample sizes, which can undermine the robustness of the findings (e.g., $N = 67$ for Michelik et al., 2012; $N = 179$ for Demarque et al., 2013). Additionally, except for Rubens et al. (2011), experiments in this field rarely include a fully factorial design with a control condition and often omit a control condition with commitment only (e.g., Demarque et al., 2013; Parant et al., 2017). Finally, many studies measure only behavioral intentions rather than actual behaviors (e.g., Joule et al., 2010; Rubens et al., 2011).

Another limitation of binding communication lies in the requirement for commitment techniques to engage deeply with the target audience, which makes their large-scale implementation more difficult. For this reason, as previously noted, mass media have so far primarily focused on persuasive communication strategies. However, recent developments in digital media - particularly the rise of streaming platforms - now offer new opportunities to test the effectiveness of commitment-based techniques in large-scale dissemination contexts.

The aim of this research is to address both limitations by providing, for the first time, a test of binding communication within a mass media context, while also addressing existing methodological shortcomings in this field of research.

5. Overview of the present research

The present research (preregistered on OSF https://osf.io/nfy7/?view_only=c0f5ef5cf8704511bab5b0d4373ab9fd) aims to overcome the limitations of existing literature on binding communication by testing the effectiveness of binding communication in promoting ecological behavior in mass media with large samples. To achieve this, Study 1 was conducted in a laboratory setting, simulating a context of mass media. With a large sample ($N = 1003$), it implemented a full

Table 1
Principals studies on binding communication.

Study	N	Conditions	Behavioral Measures
Joule et al. (2010)	60	persuasion vs. binding communication	No (Intention)
Rubens et al. (2011)	165	control vs. commitment vs. persuasion vs. binding communication	No (Intention)
Michelik et al. (2012)	67	commitment vs. persuasion vs. binding communication	No (Attitude)
Demarque et al. (2013)	179	control vs. persuasion vs. binding communication	No (Intention)
Terrier and Marfaing (2015)	187	persuasion vs. binding communication	Yes
Parant et al. (2017)	210	persuasion vs. binding communication	Yes
Fonte et al. (2017)	80	(2x) persuasion vs. (2x) binding communication	No (Intention)
Grandjean & Guéguen, 2011	116	binding communication: before vs. after	No (Intention)
Tamisier et al. (2019)	62	control vs. (3x) binding communication	Yes

Note. Commitment conditions refer to a condition which only includes a commitment technique (e.g., foot-in-the-door technique), persuasion conditions refer to a condition which only includes persuasive communication, binding communication conditions refer to a condition which includes a commitment technique and a persuasive communication.

factorial design with four conditions for producing pro-environmental behavior change in a mass media context.

We designed a second complementary study, which aimed to evaluate the effectiveness of binding communication in an ecological setting, specifically when this approach was integrated into the streaming of an audiovisual event. This study had a large sample ($N = 240,245$). We broadcast the intervention on national media (*France Télévision*) during a prime-time sports broadcast. Due to technical constraints with our distribution partner, we could only compare a persuasion condition with a binding communication condition.

In both studies, the commitment technique tested corresponds to a low-ball technique (Cialdini et al., 1978) combined with a foot-in-the-door technique (Freedman & Fraser, 1966). Regarding behavior, we chose to target behavior aimed at reducing digital pollution. Beyond methodological considerations, namely the need to select a behavior that is simple enough to measure, this choice is supported by several sustainability-related arguments. First, the digital sector is currently responsible for 4 % of global greenhouse gas emissions and is growing at a rate of 9 % per year (Sharma & Dash, 2023; World Favor, 2022). Moreover, the rapid expansion of emerging technologies, particularly artificial intelligence, suggests a troubling increase in the sector's environmental footprint (OECD, 2022). Finally, the selected behavior aligns with commitment theory. Specifically, it is low-cost, non-polarizing, and easy to perform. According to commitment theory, such behavior can foster individual commitment, which may, in turn, lead to the adoption of more demanding and consistent pro-environmental actions. In this case, engaging in a low-cost ecological behavior may increase the likelihood of subsequently adopting more effortful ecological behaviors, thereby contributing, beyond the scope of the experimental setting, to the effective addressing of environmental challenges more effectively. In addition to measuring behavior, we also assessed individuals' attitudes toward digital pollution.

It is important to note that in the binding communication condition of our studies, persuasive communication was presented before the commitment technique was introduced. While this could be considered an unusual order, such a methodological choice has already been validated in previous research on binding communication (Tamisier et al., 2019). This was due to the adaptation of the audiovisual communication setup. Indeed, encountering a preparatory act unsupported by persuasive content might appear strange to viewers in an audiovisual context. While researchers in this field have argued that a preparatory act helps increase receptivity to persuasive communication, we could also argue the opposite. As shown by attitude-behavior models (e.g., theory of planned behavior; Ajzen, 2012), an attitude change through persuasive communication can lead to a greater behavioral intention, which may, in turn, increase individuals' receptivity to the preparatory request of a commitment strategy.

6. Study 1: a complete test of binding communication in behavior change

We set out to test our hypotheses in a laboratory setting, in a laboratory setting simulating the streaming of a sports television show. To examine the additive effect of combining commitment and persuasion, we designed a four-condition, between-subjects experimental design: (1) a control condition (without persuasion or commitment), (2) a persuasion condition, (3) a commitment condition, and (4) a binding communication condition (combining both commitment and persuasion). For the pro-environmental behavior measure, we focused on digital sobriety. Digital pollution not only has significant ecological consequences but also represents a behavioral target that can be easily operationalized in a digital media context. The behavioral measure assesses the proportion of participants who submitted a screenshot as proof that they had successfully deleted spam emails from their inbox.

We formulated two hypotheses, both suggesting an additive effect of binding communication. For the first hypothesis, we expected binding

communication to be more effective than either persuasion or commitment used in isolation. Furthermore, we hypothesized that commitment would be more effective than persuasion in driving behavior change, based on prior research comparing these strategies (Bazart et al., 2022; Mickaël, 2014). For the second hypothesis, we again expected binding communication to be more effective than either strategy used alone, but we did not anticipate a difference in effectiveness between commitment and persuasion. We also measured participants' attitudes toward digital pollution. Studies on binding communication have shown that this combined approach can enhance attitude change (e.g., Michelik et al., 2012). Thus, we expected participants in the binding communication condition to hold more favorable attitudes toward combating digital pollution than those in the commitment and persuasion conditions.

7. Participants, recruitment and sample size analysis

Participants were recruited through the online platform Bilendi. To be included in the study, they had to complete the task on a computer to facilitate screenshot capture and submission. Additionally, to remain as close to real-life conditions as possible, a second inclusion criterion required that participants have watched at least one match from the targeted tournament in the past two years. Participants were recruited using the quota sampling method, ensuring an even distribution across our four experimental conditions in terms of age, PCS, region, and agglomeration size. We aimed to recruit 1000 participants and conducted an a priori sensitivity analysis for a one-way interaction on attitude scores, using an alpha level of 0.05 and 80 % statistical power. The sensitivity analysis indicated that the minimum detectable effect size was $d = 0.20$. The final sample included 1003 participants ($M_{age} = 51.11$, $SD_{age} = 16.61$; 34 % female, 66 % male).

8. Materials

Persuasive Communication. In the present study, persuasive manipulation relied on the dissemination of a message designed as a television spot. This format is particularly suited to situations involving mass communication channels (see Petty et al., 2002). The construction of the message was guided by knowledge from the psychology of persuasion. First, based on the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1984) and considering the context of diffusion, we chose to emphasize peripheral cues in developing the message. Indeed, since the message was broadcast during an audiovisual sporting event, we assumed that individuals would likely have low motivation to process the information. For this reason, rather than developing in-depth arguments via the central route, we focused on the source as a peripheral cue (see Cacioppo et al., 1986; Petty et al., 1994; Xiu et al., 2024). To this end, the message was delivered by the former captain of the French rugby team (i.e., Mathieu Bastareaud), who can be considered an attractive and influential source for French rugby spectators.

Regarding the content, the message unfolded in three phases. The first phase aimed to introduce an argument on the effects of climate change on sports ("Training times have changed a lot; we either train very early or a bit later because the heat becomes difficult for the body"), including a moderate fear appeal (Chen, 2016; Pelletier & Sharp, 2008). This first sequence, by linking sport to climate change, established coherence with the context of diffusion (i.e., an audiovisual sporting event). The second phase presented arguments concerning the impact of digital pollution on climate change. These arguments were framed negatively (Homar & Cvelbar, 2021; Pelletier & Sharp, 2008), highlighting the harmful consequences of unsustainable digital consumption rather than the benefits of digital sobriety ("If the Internet were a country, it would be the third largest electricity consumer in the world.", "... between 10 and 12 billion emails are exchanged every hour worldwide."). Finally, the last phase proposed simple actionable solutions to increase self-efficacy ("do not store emails, limit the number of recipients, and use spam filters"). The video concluded with the WWF

logo, a highly recognized NGO, serving as an eco-label (Sörqvist et al., 2015; Thoegersen, 2002), even though the spot had no commercial objective.

Regarding the laboratory diffusion context, the message lasted 60 s. Due to constraints imposed by the broadcaster for the second study, exceeding this duration was not possible. We therefore chose the maximum possible duration (i.e., 60 s), as it has been shown that there is a positive relationship between advertisement duration and effectiveness (Jeong et al., 2011). Finally, to create an immersive setting, the message was preceded by 4 min and 35 s of a Six Nations rugby match, covering the last action before halftime, as well as 26 s of a jingle presenting the sponsors of the French team. The full script of the message and the television spot used are available on the OSF platform (https://osf.io/nfye7/?view_only=c0f5ef5cf8704511bab5b0d4373ab9fd).

Commitment Techniques. In this study, we incorporated a combined foot-in-the-door and low-ball strategy to foster commitment. To manipulate the foot-in-the-door, participants were first presented with a preparatory request asking them whether they would agree to complete and validate a small challenge related to digital pollution.

“We’re inviting you to take part in a little challenge on digital pollution. Will you accept the challenge?”

Following the preparatory request, participants in the commitment conditions were presented with the target request, which invited them to go to the spam section of their email inbox, delete the spam messages, and then send a screenshot as proof:

“We’d like to invite you to take part in a little challenge on digital pollution, which involves deleting spam from your mailbox.

Once you’ve deleted your spam, upload a screenshot of your emptied spam below.”

The low-ball technique was implemented within the preparatory request by concealing the inherent costs of the target behavior (i.e., accessing the email inbox, deleting spam messages, and sending a screenshot).

Target Behavior. In this study, we chose to focus on the adoption of a digital sobriety behavior. Specifically, participants were asked to access the “spam” section of their email inbox, delete its contents, and submit a screenshot confirming that the folder had been emptied. Sending a screenshot was coded as 1 (i.e., behavior performed), while failure to send one was coded as 0 (i.e., behavior not performed). Upon reviewing the submitted screenshots, we found that some did not correspond to the spam section of participants’ inboxes. As this exclusion criterion was not pre-registered, we systematically conducted two sets of analyses: one including all screenshots received, and another excluding those that did not explicitly show the spam section.

9. Procedure

The study was carried out online via the Bilendi platform. After signing a consent form, participants were informed that they would be watching a sequence from a match featuring the French team during the Six Nations 2023 rugby tournament. Thanks to a partnership with France Télévision and WWF France, we created a video mimicking a live-streamed broadcast. The video included the last play before halftime, followed by the France Télévision credits sequence and a commercial from one of the French rugby team’s sponsors. Participants were randomly assigned to one of four experimental conditions: a control condition (i.e., without persuasive communication and without a commitment technique, $n = 250$), a persuasion condition (i.e., persuasive communication without a commitment technique, $n = 250$), a commitment condition (i.e., a commitment technique without persuasive communication, $n = 250$), and a binding communication condition (i.e., persuasive communication combined with a commitment technique, $n = 253$).

In the conditions involving persuasive communication (i.e., persuasion condition and binding communication condition), participants watched a persuasive message about reducing digital pollution (see Materials), which we produced specifically for the experiment. In conditions involving a commitment strategy (i.e., commitment condition and binding communication condition), participants were first exposed to a preparatory request designed to operationalize the two commitment techniques used (see Materials). It is worth noting that in the binding communication condition, the preparatory request implementing the two commitment strategies was presented after the persuasive communication. Finally, all participants were presented with the target request, inviting them to access their email inbox to delete their spam, take a screenshot of the deletion, and send it (see Materials). After being presented with the target request, participants were asked to report their attitude towards reducing digital pollution using a 5-point rating scale (1: strongly disagree, 5: strongly agree). Finally, participants were debriefed and thanked for their participation.

10. Results

To test our two additive hypotheses regarding behavior, we constructed a family of contrasts. The first contrast aims to evaluate the effect of the strategies in general compared to the control condition (C1: 3 control, +1 persuasion, +1 commitment, +1 binding communication).¹ The second contrast compares both the persuasion and commitment conditions with the binding communication condition to test the hypothesis of an additive effect (C2: 0, -1, -1, +2). We also defined a third contrast that compares the relative effectiveness of a commitment technique and a persuasive strategy (C3: 0, -1, +1, 0). To analyze these contrasts, we constructed a logistic regression model with the completion of the behavior as the dependent variable (1 = Yes vs. 0 = No) and the three contrasts as predictors.

First, the descriptive results highlight the pattern predicted for the first hypothesis (see Fig. 1). Indeed, the proportion of behaviors performed in the persuasion condition (18.00 %) was close to that observed in the commitment condition (18.40 %). In contrast, the control condition showed a lower rate of behavior (12.40 %) compared to the persuasion and commitment conditions. Conversely, the binding communication condition yielded a higher rate (26.90 %) than both conditions.

Globally, the logistic regression model was significant, $Z = -17.92$, $p < .001$, $OR = 0.23$, 95 % CI [0.19, 0.27], suggesting a difference between our different conditions in terms of behavior performance. More precisely, the C1 contrast was found to be significant, $Z = 2.92$, $p = 0.004$, $OR = 1.17$, 95 % CI [1.05, 1.30]. This result suggests an overall effect of exposure to a strategy (persuasive and/or commitment) on behavior change. Furthermore, the C2 contrast was also significant, $Z = 2.74$, $p = 0.006$, $OR = 1.18$, 95 % CI [1.05, 1.33]. These results support the hypothesis of an additive model, as the behavior change was greater in the condition where both types of strategies were combined compared to the conditions where participants were exposed to either persuasive communication or a commitment technique alone. Finally, contrast C3 was found to be non-significant, $Z = 0.12$, $p = .91$, $OR = 1.01$, 95 % CI [0.81, 1.27]. This result suggests that the commitment technique alone was not more effective than persuasive communication alone in driving behavior change. As indicated earlier, when examining the data, we realized that a certain number of screenshots sent (13.77 %) did not correspond to the required spam section of the mailbox. Because this was not anticipated in the pre-registration process, but did not match the expected behavior, we added this exclusion criterion and replicated the previous analyses after exclusion. The results obtained are similar to

¹ Due to an oversight when coding the contrasts in our pre-registration, we recorded our contrast family to maintain orthogonality while ensuring that our hypotheses could still be tested.

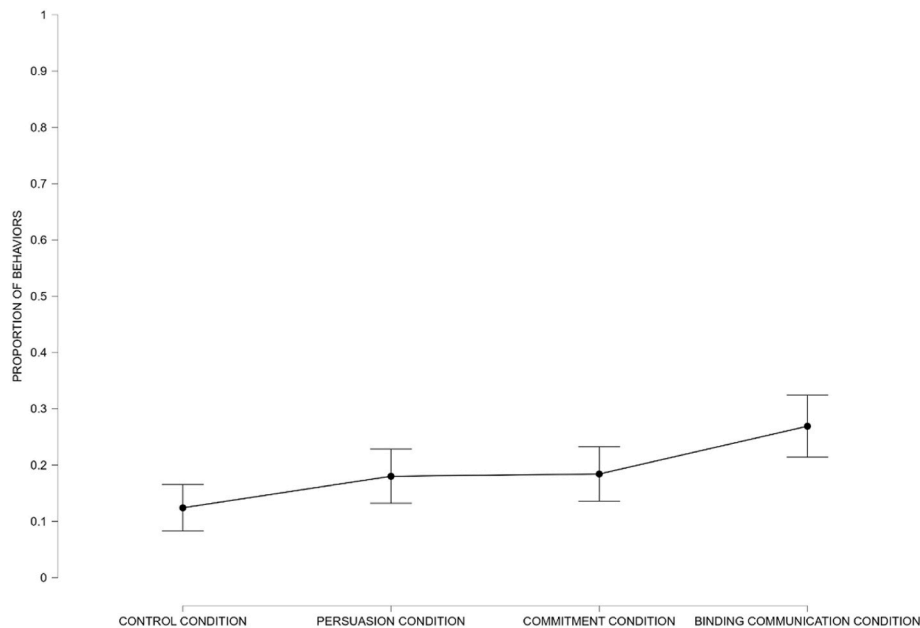


Fig. 1. Proportion of Behaviors According to Experimental Condition
Note. Error bars represent 95 % confidence intervals.

those observed without the exclusion of the participants, since the C1 contrast is significant, $Z = 2.87$, $p = 0.004$, $OR = 1.18$, 95 % CI [1.05, 1.32] as well as the C2 contrast, $Z = 2.24$, $p = .025$, $OR = 1.16$, 95 % CI [1.02, 1.31]. The C3 contrast remained non-significant, $Z = 0.36$, $p = .72$, $OR = 1.05$, 95 % CI [0.82, 1.33].

We used the same contrast family to test our hypotheses on attitude change this time. Descriptive analysis shows a higher attitude in the persuasion condition ($M = 4.16$, $SD = 0.88$) compared to the commitment condition ($M = 4.10$, $SD = 0.87$), the binding communication condition ($M = 4.04$, $SD = 0.96$), and finally the control condition ($M = 3.95$, $SD = 0.96$). First, we conducted a one-way ANOVA, which showed a marginally significant result, $F(3, 999) = 2.47$, $p = .06$, $\eta^2 = 0.01$. Then, we examined the results for each contrast. Contrast C1, which compared the control condition to the three conditions implementing a strategy, was found to be significant, $t(999) = 2.26$, $p = .02$, $b = 0.04$, 95 % CI [0.01, 0.07], $d = 0.14$. This contrast indicates that, in the conditions implementing a communication strategy, the attitude toward combating digital pollution proved to be higher than in the control condition. Contrast C2, which compared the binding communication condition with the persuasion and commitment conditions, was not significant, $t(999) = -1.28$, $p = .20$, $b = -0.03$, 95 % CI [-0.08, 0.02], $d = 0.08$. Similarly, contrast C3, which compared the persuasion condition to the commitment condition, was also not significant, $t(999) = -0.83$, $p = .41$, $b = -0.03$, 95 % CI [-0.12, 0.05], $d = 0.05$. As an exploratory analysis, we conducted post-hoc comparisons. Only the mean difference between the control condition and the persuasion condition was found to be marginally significant after Holm correction, $t(999) = 2.63$, $p_{holm} = 0.05$, $MD = 0.22$, 95 % CI [-0.001, 0.43], $d = 0.24$.

11. Intermediate discussion

In Study 1, we aimed to verify whether combining a commitment technique with persuasive communication would be more effective in changing behavior and attitudes than the two strategies used in isolation (i.e., the hypothesis of additivity). Regarding behavior change, we expected that the persuasion and commitment conditions would be equally effective, or that the commitment condition would outperform the persuasion condition. The results confirmed the hypothesis of an additive effect of commitment and persuasion strategies on behavior change.

Furthermore, we observed that using both a commitment technique and a persuasion strategy was effective in promoting behavior in the streaming context. Contrary to previous studies comparing the effectiveness of a commitment strategy and persuasive communication (Bazart et al., 2022; Mickaël, 2014), this effect was not observed in our study.

Regarding attitude, we observed a weak effect of the experimental conditions on attitude change compared to the control condition, which was mainly explained by the difference between the control condition and the persuasion condition. Descriptively, it appears that in this sample, the conditions involving a commitment technique had a smaller effect on attitude change than the persuasion condition, although the differences in this comparison were not statistically significant.

After having validated the effectiveness of our binding communication intervention in a controlled experimental environment, the second study aims to test the same intervention in a naturalistic setting, to evaluate whether the observed effects transfer to real-world conditions and to strengthen its ecological validity.

12. Study 2: a large and ecological test of binding communication on mass media

Study 2 aimed to test the effectiveness of binding communication in ecological conditions during the streaming of an audiovisual show. As in Study 1, the commitment technique involved a foot-in-the-door associated with low-ball and the aim of the intervention was to reduce digital pollution, with the target behavior being the deletion of spam from individuals' mailboxes. In this study, given the constraints of our broadcasting partner, we compared two levels of a between-subjects independent variable (persuasion condition vs. binding communication condition). The absence of a control condition is justified by the ecological nature of the study, conducted on a mass media platform that traditionally relies on persuasive communication. Indeed, it would have been unusual for viewers to see only the behavioral request appear without any preceding message. Regarding our two conditions, we hypothesize that participants exposed to the binding communication condition will be more likely to express the intention to perform the behavior than those in the persuasion condition.

13. Participants

The study was carried out in partnership with *France Télévision Publicité* and *WWF France*. *France Télévision* only provided us with the number of participants per experimental condition, as well as the number of participants who validated the intention to perform the behavior. Due to constraints imposed by the broadcaster (notably the impossibility of collecting identifying data), only behavioral intention (i.e., a click) was measured in this study, with no possibility of post-exposure follow-up to assess actual behavior. This large-scale study involved 240,245 participants recruited between February 5, 2023, and February 11, 2023.

14. Procedure

The setup was broadcast during the first two matches of the French rugby team in the Six Nations 2023 tournament on *France Télévision's* streaming site. The setup was presented to participants as they connected to the streaming site, before they began watching the match. For the purposes of the experiment, participants were randomly assigned to one of two experimental conditions. In the persuasion condition ($n = 110,789$), participants began by viewing the persuasive communication used in the first study, then had to directly indicate their intention to delete their spam within 24 h by clicking on the streaming screen. In this sense, we measured the click behavior associated with this request. In the binding communication condition ($n = 129,456$), participants also viewed the persuasive communication and were then exposed to a preparatory request that incorporated low-ball and foot-in-the-door techniques.

15. Results

To test our hypothesis, we created a logistic regression model with the condition as the independent variable (+0.5 for the binding communication condition and -0.5 for the persuasion condition) and the acceptance rate of the request as the dependent variable (i.e., click behavior). In line with this hypothesis, participants in the binding communication condition were more numerous ($n = 414$, 0.32 %) than participants in the persuasion condition ($n = 177$, 0.16 %) to indicate the intention to carry out the target request, and this result was significant at the 0.05 alpha level, $Z = 7.74$, $p < .001$, $OR = 2.00$, 95 % CI [1.68, 2.39].

16. Intermediate discussion

After verifying the effectiveness of binding communication on behavior in a laboratory setting using a complete experimental design, we applied this strategy in an ecological context by streaming an audiovisual event to a large sample. Consistent with the results of the first study, we observed that participants in the binding communication condition exhibited a click rate - an indirect indicator of the intention to delete spam - that was twice as high as that of participants in the persuasion condition.

17. General discussion

In this research, our primary objective was to test the effectiveness of binding communication when implemented in the context of mass audiovisual broadcasting to promote the adoption of pro-environmental behavior. Additionally, our secondary objective aimed to address certain methodological limitations present in existing studies on binding communication through a replication with a large and representative sample, a full factorial design, and a measurement of behavior. To achieve these goals, we designed two complementary studies: the first conducted in a laboratory setting and the second in an ecological context, during the broadcasting of a sporting audiovisual event.

In the first study, we observed that binding communication was more effective than traditional persuasive communication or commitment techniques in promoting pro-environmental behavior. However, we did not observe a significant difference in terms of attitude change. In fact, binding communication did not outperform persuasive communication in terms of attitude change.

In the second study, we again found that binding communication was more effective than traditional persuasive communication, but this time in an ecological context, during the broadcasting of an audiovisual event to a large sample ($n = 240,245$). These results confirm the superiority of binding communication over persuasive communication in promoting pro-environmental behavior. We also demonstrated that binding communication is easily adaptable to mass broadcasting, thus retaining its effectiveness compared to traditional communication methods.

The fight against climate change requires the development of effective strategies to encourage behavior change, while being scalable to reach a large and heterogeneous audience. Until now, the constraints of mass media had previously only allowed the use of persuasive communication, which is less effective at changing behavior than commitment techniques or their combination with persuasion (i.e., binding communication). Building on the digitalization of audiovisual broadcasting, we were the first to test the effectiveness of binding communication in mass media. While psychological research focuses on developing strategies to promote pro-environmental behaviors, we believe it is also essential for researchers to consider the conditions necessary for the scaling of these strategies to fully address the challenges posed by climate change. Our research aligns with this perspective by aiming to define a trade-off between the behavioral effectiveness of strategies and their scalability, while attempting to address this challenge, for example, by testing the effectiveness of binding communication in the context of mass audiovisual broadcasting.

Moreover, while literature has highlighted the advantages of combining a commitment technique with persuasive communication, existing studies have significant methodological limitations. We have attempted to overcome these limitations, particularly in Study 1, by conducting a test on a large sample, with a rigorous experimental design, and by measuring real behavior. By addressing these methodological limitations, our results demonstrate a robust effect of binding communication on behavior.

18. Limitations and future directions

Nonetheless, this research presents several limitations. First, the target behavior (i.e., spam deletion) is relatively low-cost, which may raise questions about the effectiveness of the strategy for higher-cost behaviors. It is important to emphasize, however, that our design was experimental and that the behavioral cost was held constant across conditions. Therefore, our results show that, at equivalent cost, binding communication proves more effective than strategies implemented in isolation or than the control condition. Nevertheless, it remains possible that a higher-cost behavior might trigger a threshold effect, eliminating the differences observed here between conditions. It should be noted that, due to logistical constraints inherent in experimental settings, the few prior studies that have gone beyond measuring intention by assessing actual behavior have also focused on low-cost behaviors (e.g., providing an email address, Parant et al., 2017; reusing towels in a hotel, Terrier and Marfaing, 2015). Future research should investigate the interaction between strategy type (commitment, persuasion, binding communication) and behavioral cost to determine whether the additive model shown in the literature also applies when the cost of the target behavior increases. Finally, consistent with the assumptions of commitment theory, encouraging participants to perform low-cost behavior within the experiment (e.g., here, deleting emails) can be seen as a preparatory act that facilitates later adoption of higher-cost behaviors. In other words, although the strategy tested here directly affects low-cost behavior, it may have effects beyond the experiment's

scope on higher-cost behaviors by initiating a commitment dynamic.

A second point of caution concerns the durability of the effects of binding communication in the medium and long term. Although research on this strategy has not specifically examined the temporal evolution of its effectiveness through follow-up studies, it is noteworthy that the popularity of commitment techniques partly relies on their capacity to produce more lasting effects than other forms of communication (Abrahamse et al., 2005; Burger, 1999; Cialdini, 2001; Lokhorst et al., 2013). Nilsson et al. (2017) suggest that the persistence of effects observed after applying a commitment technique could be explained by a post-decisional rationalization process; acceptance leads to the internalization of the behavior, resulting in consistent subsequent actions, just like the cognitive dissonance process. However, longitudinal studies remain scarce, and to our knowledge, no one has specifically focused on binding communication over the long term. Further research is therefore needed to assess the stability of its effects over time.

A third limitation concerns the second study, in which we measured behavioral intention through an indirect indicator (i.e., click rate). This choice was dictated by the mode of dissemination (i.e., in a real-world setting during a live sport audiovisual event). This presented an unprecedented setting with substantial statistical power for this type of study but did not allow us to identify participants or follow up with them to verify whether they actually deleted their spam emails. Nonetheless, the equivalence of the experimental setups across the two studies allows for a stronger inference regarding the actual adoption of the behavior in the second study. Indeed, if Study 1 shows that the binding communication strategy induces a greater behavior change than the persuasive strategy alone, and Study 2, which uses exactly the same procedure for the same behavior, reveals a stronger intention in the binding communication condition than in the persuasion condition, it is reasonable to assume that participants exposed to the binding strategy were indeed more likely to have deleted their spam emails.

Lastly, our study primarily aimed to replicate previous work on binding communication by addressing current methodological limitations while enhancing ecological validity through large-scale testing of this technique on a diffusion channel not previously explored in the literature. Consequently, the article did not focus on the underlying mechanisms of binding communication. Nevertheless, a discussion can be initiated on more theoretical questions, for example regarding the sequencing of the two strategies, as well as factors that might make one order more effective than the other. Indeed, following Tamisier et al. (2019), and due to constraints linked to our diffusion mode, we positioned the persuasive message upstream of the commitment strategy, whereas other studies have adopted the reverse order. Although both orders appear to show an additive effect of binding communication, the literature does not provide a model to predict which factor might moderate the effectiveness of the two sequences. The “commitment then persuasion” order relies on the hypothesis that the engaging act induces a motivation to maintain consistency, thereby facilitating the integration of the persuasive message and promoting attitude change (e.g., Girandola & Joule, 2012). This arrangement might be particularly suited when individuals initially hold an unfavorable attitude towards the targeted behavior. Regarding the cognitive dynamics at play, the effectiveness of this sequence for individuals with initially low attitudes who perform a preparatory behavior could be interpreted through a cognitive dissonance regulation mechanism (Festinger, 1957; Joule et al., 2007). One could hypothesize that the level of cognitive dissonance mediates the relationship between initial attitude and adoption of the target behavior, specifically in the “commitment then persuasion” condition. Conversely, starting with a persuasive message, when the initial attitude is unfavorable, might trigger a boomerang effect reducing the effectiveness of binding communication. The “persuasion then commitment” order, by contrast, could prove more effective when attitudes towards the behavior are favorable but do not translate into action - as illustrated by the green gap observed in pro-environmental behavior (e.g., Byfuglien et al., 2025; Carrus et al., 2021). By

cognitively activating the attitude (Bassili, 1996; Fabrigar et al., 2019), this sequence could strengthen acceptance of the preparatory request, thereby increasing the likelihood of action - an effect that the reverse sequence logically cannot achieve. In this case, the psychological process involved might be the availability of the attitude (Fabrigar et al., 2019). Beyond its theoretical interest, this question holds important strategic implications for the targeted development of binding communication depending on audience characteristics, notably their initial attitudes.

19. Conclusion

In conclusion, this study is the first to test binding communication and, more broadly, commitment techniques, within the context of a large-scale audiovisual event with a sample of 240,245 individuals. We demonstrate the feasibility of scaling commitment strategies which, although potentially effective, entail a significant cost given the level of interaction required with the target audience. Research on behavior change strategies often focuses on improving their effectiveness but sometimes overlooks the conditions for their implementation. We believe that the fight against climate change requires researchers, when developing and studying strategies, to systematically consider the conditions of their application, especially regarding their large-scale deployment, in order to respond effectively to climate emergency.

CRedit authorship contribution statement

Benjamin Aubert-Teillaud: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Maxime Mauduy:** Writing – review & editing, Writing – original draft, Visualization, Validation, Formal analysis. **David C. Vaidis:** Writing – review & editing, Writing – original draft, Validation, Supervision, Methodology, Conceptualization.

Ethical statement

In France, since the research conducted does not fall under the scope of the Jardé Law, we are exempt from the requirement to submit the study to an ethics committee. However, we have ensured that the study adhered to the principles outlined in the 1947 Nuremberg Code and the Helsinki Declaration, prioritizing the protection of participants’ rights, welfare, and dignity throughout the research process.

Declaration of generative AI and AI-assisted technologies in the writing process

During the final writing process of this paper the authors used a Large Language Model to improve some English writing styles and to check for grammar and orthography mistakes. At each step, the authors reviewed and edited the content. They endorse full responsibility and authorship for the publication but save a lot of money, their poor institutions cannot provide for this task.

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Appendix A. Supplementary data

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Further reading

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