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Emotional and Cognitive Processes Underlying Persuasion, Moderating Factors, and Physiological Reactions: A Systematic Review

Valerie Rodríguez-Hernández
Laboratory of Social Cognitive Neuroscience, Department of Psychobiology, IDOCAL, University of Valencia, Valencia, Spain

Vanesa Hidalgo
Department of Psychology and Sociology, Area of Psychobiology, University of Zaragoza, Teruel, Spain

Laboratory of Social Cognitive Neuroscience, Department of Psychobiology, IDOCAL, University of Valencia, Valencia, Spain

Alicia Salvador
Laboratory of Social Cognitive Neuroscience, Department of Psychobiology, IDOCAL, University of Valencia, Valencia, Spain

Spanish National Network for Research in Mental Health CIBERSAM, Madrid, Spain

Abstract

Persuasion is a type of social influence aiming to produce changes in others' attitudes or behaviors. This study explores the relationship between emotions and persuasion, principal moderating factors, and physiological reactions during persuasive attempts. Following PRISMA guidelines, 28 empirical articles were analyzed, addressing emotions, affective/cognitive orientations, framing effects, and psychophysiological reactions. Mixed findings emerged regarding emotions, with fear appeals being effective in health education, while more recent studies favor the use of positive persuasive messages to

Corresponding Author:
Alicia Salvador, Facultad de Psicología, Universitat de Valencia, Av. Blasco Ibáñez, 21, Valencia 46010, Spain.
Email: alicia.salvador@uv.es

increase behavior intention. Principal moderating factors included personal relevance, need for cognition (NFC) and need for affect (NFA), thought confidence, vulnerability, and efficacy beliefs. Psychophysiological studies revealed distinct physiological arousal during persuasion processing compared to a rest state. In addition, a greater misalignment between current behavior and the persuasive attempt led to perceived freedom threat and psychological reactance. These insights enhance persuasive effectiveness and deepen understanding of persuasion processes, guiding future research directions.

Keywords
Persuasion, attitude change, emotions, cognition, psychophysiology of persuasion

Introduction

People are constantly exposed to persuasive messages from multiple sources and with various message frames. Attempts to persuade can be made by an individual, a group, or a social entity (Cacioppo et al., 2018), such as a marketer, a political party, or a health enterprise. Persuasion is one of the most important types of social influence. Specifically, it refers to the attempt to produce a change in a person's attitude, beliefs, desires, or behavior. This is an age-old subject in human societies, so persuasion was an object of reflection in Greek philosophy many centuries ago (Aristotle, 1926). The relevance and ubiquity of persuasive messages have led to a growing body of research aiming to identify the factors intervening in effective persuasion, that is, in obtaining a behavior change.

Framework

Much of the work on this topic is explained using dual and multi-process theories of persuasion (Chaiken, 1987; Petty & Briñol, 2015), which posit that the extent of elaboration the individuals engage in influence the effectiveness of the message. Petty and Cacioppo (1986) formulated the Elaboration Likelihood Model (ELM) to explain the existence of two distinct routes to persuasion: central route, when people have a thoughtful and analytic message elaboration; and peripheral route, when people rely on a shortcut decision-making rule, without message scrutiny. The ELM states that a persuasive message can affect the amount and direction of an attitude change in three ways: affecting the *argument quality* (i.e., the persuasiveness of the message itself), affecting the recipient's *argument elaboration*, and serving as a *peripheral cue*.

While *"argument quality"* refers to how the message is constructed by the source or persuader, *"argument elaboration"* refers to the recipient's cognitive elaboration; the latter affects information processing, especially the motivation to scrutinize a message. One factor influencing argument elaboration is personal relevance, also called

involvement (Cacioppo & Petty, 1982; Petty et al., 1981). When a topic has high personal relevance, the tendency to carefully consider argument quality is greater; however, when personal relevance is low, the message's peripheral cues become more dominant. Other important factors also influencing argument elaboration are personal responsibility (Petty & Cacioppo, 1986), self-perceived vulnerability (Das et al., 2003), thought confidence (Petty et al., 2002; Briñol et al., 2023), and the need for cognition (Cacioppo & Petty, 1982), among others. Lastly, *peripheral cues* act when the elaboration is low or absent. In this case, some of the most common cues the recipient uses are source expertise (Cacioppo & Petty, 1982; Petty et al., 1981), source attractiveness (Chaiken, 1979), and emotions (Petty & Briñol, 2015), among others. Regarding emotions, its relationship with persuasion is complex and has effects via multiple processes, depending on the extent of elaboration the individual engages in, high or low (Briñol et al., 2007). Finally, it is important to mention that the persuasive efficacy through the transit of the central route in the processing of persuasion is more enduring than via the peripheral route (Petty and Cacioppo (1986).

Strategies to Enhance the Efficacy of a Persuasive Message: Matching and Framing

Besides the aforementioned factors influencing the recipient's argument elaboration, there are components used by the source to enhance the efficacy of a persuasive message, such as matching and framing an argument to people's attitudes or tendencies. *Matching* messages with people's psychological states boosts involvement and message elaboration (Petty & Cacioppo, 1986), increases subjective processing fluency (i.e., easier processing) (Lee & Aaker, 2004), enhance the recognition and recall of the target (Lee & Labroo, 2004; Mayer & Tormala, 2010), influences the time spent reading messages (See et al., 2008), and is likely to bias the recipient's perception of message validity and, in turn, post-message attitudes (Lavine & Snyder, 1996). However, the functional match of the message is more effective when argument quality is strong; if it is weak, the match could have the opposite effect, since the recipient could be more engaged in scrutinizing content that matches their attitudes or tendencies. If the arguments are weak, the mismatching is likely to be more persuasive and effective (Petty & Wegener, 1998).

Framing is a typical method to express the match/mismatch effect. The framing effect is a process of social influence connecting the message discourse with the recipient (Pan & Kosicki, 2005). *Message framing* involves a message source highlighting some aspects of an issue in a certain interpretative framework to influence the recipient's subsequent evaluation of the target. A *psychological frame* is endogenous to the individual, a cognitive node stored in people's memory about social objects. They are activated by dispositional individual differences and situational factors, such as frequency (Shen, 2010). Once the cognitive construct is activated during message processing, it is more likely to be applied in response to subsequent evaluations, known as the accessibility effect. Repetitive exposure to certain frames over others results in an

information accessibility bias (Nabi, 2003; Price & Tewksbury, 1996). By using these strategies, the information's framing makes certain elements look more important and subsequently influences an individual's judgment (Pan & Kosicki, 1993).

Psychological Traits

As stated above, argument elaboration is also influenced by individual tendencies for need for cognition (NFC) and need for affect (NFA). On the one hand, NFC is defined as an individual's need to understand and structure situations (Cacioppo & Petty, 1982; Cohen et al., 1955). Individuals high in NFC tend to enjoy the act of thinking, engage in effortful cognitive activities, and seek out more information before making an evaluation or judgment (Haddock et al., 2008), whereas individuals low in NFC tend to use other sources, such as heuristics, to understand situations (De Holanda Coelho et al., 2018). On the other hand, NFA is defined as people's general motivation to approach or avoid situations and activities that are emotion-inducing for themselves and others (Appel et al., 2012; Maio & Esses, 2001). It involves a desire to understand emotions and use them to shape judgments and behavior. The tendencies towards NFC[1] and NFA are moderators in determining the extent of the argument elaboration, and which type of processing route to travel through (Cacioppo & Petty, 1982), central or peripheral. In addition to these dispositional determinants of the extent of elaboration, there are situational factors or psychological states which determine which route of processing would be followed.

Emotions (Psychological States)

The effects of emotions on persuasion have been widely studied. According to Petty et al. (2001), "emotions can influence attitudes by peripheral mechanisms (such as classical conditioning), serve as items of issue-relevant information, bias message processing, and determine the extent of message scrutiny" (p. 228). If an individual's cognitive elaboration is seen as a continuum, emotions have a different effect depending on which end of the continuum the individual is: at the low end (i.e., low motivation and ability to think), or at the high end (i.e., high motivation and ability to think systematically). Petty and Briñol (2015) called it "moderated mediation," since the level of elaboration will moderate the effect an emotion will have in any persuasive attempt.

Some works have studied the role of emotions from a positive versus negative affective valence perspective (Lerner & Keltner, 2000; Petty et al., 2001), while others have focused on the effects of discrete emotions of the same valence (Keltner et al., 1993; Lerner & Keltner, 2000). For instance, in low-elaboration conditions, positive emotions are associated with more positive attitudes, less message elaboration, no argument quality distinction, and thereby, more persuasion by peripheral mechanisms (Mackie & Worth, 1991; Petty et al., 1993, 2001; Schaller & Cialdini, 1990). In contrast, negative emotions produce more negative attitudes, more elaboration, more

differentiation between strong and weak arguments, and more attention to central appeals (Keltner et al., 1993; Petty et al., 2001; Schaller & Cialdini, 1990).

Psychophysiology of Persuasion

A relevant aspect to understand the consequence of persuasion on a person's motivational state is to explore its physiological state. From a psychophysiological perspective/point of view, it is assumed that every mental state has a physical substrate, and it can be more comprehensible to study both aspects. For this reason, through the study of the psychophysiology of persuasion, it is possible to clarify the relationship between information processing and the corresponding underlying mechanisms.

Most persuasion literature that studies the physiological response, has results in line with the psychological reactance to persuasion. People experience psychological reactance when something is perceived as a threat to certain freedoms. According to the theory of psychological reactance (Brehm, 1966), any persuasive message may arouse a motivation to reject the advocacy (Dillard & Shen, 2005). Feelings of reactance are best described as unpleasant motivational arousal (Steindl et al., 2015), with negative cognitions and emotions. Since persuasion aims to change an attitude or intention that results in a behavioral change, an individual may feel frustrated or annoyed when confronted with a restriction to their free behavior, leading to a state of reactance.

While the psychophysiological reactance findings are promising and worth exploring, the evidence about the physiological response to persuasion itself is scarce. This is relevant as the existing literature has demonstrated that both affective valence and the level of arousal influence consumers' choices and decision-making (Di Muro & Murray, 2014). According to Storbeck and Clore (2008), while the affective valence (i.e., positive, or negative) of emotions gives information about the value of an object or a stimulus, the affective arousal dimension informs about the importance of personal relevance. The motivational state of arousal can affect judgment, processing, attention, and memory.

There is a growing interest in the integration of social, psychological, and biological perspectives on persuasion, mainly within the Social Neuroscience (see reviews: Baek & Falk, 2018; Cacioppo et al., 2018; Falk et al., 2010; Falk & Scholz, 2018; Kaye et al., 2017). However, a significant gap remains in research that explores the effect of emotions and cognition in persuasion, integrated with the psychophysiological responses. These responses, including cardiovascular, electrodermal, and electromyography, among other physiological reactions, have been lacking in the empirical research of persuasion, and to our knowledge, no systematic review has comprehensively addressed the intersection of these dimensions. This article aims to fill that gap by offering a thorough review of the literature on emotional and cognitive processes underlying persuasion, moderating factors, and physiological reactions.

In sum, knowing the principal factors that moderate the extent of persuasive elaboration and the underlying processes is relevant in many fields such as health, advertising, politics, economics, and social issues; all of which use persuasion to try to

change attitudes or behaviors. We know some important factors such as personal relevance or individual tendencies that affect the persuasion processing, however, the overview of how those factors interacted in the emotion and persuasion relationship is something to explore. In addition, the study of the principal moderator factors that determine which processing route to take and the physiological reactions in response to that momentary state, can increase the persuasive efficacy and our understanding of persuasion. In particular, the understanding of the psychophysiology of persuasion which is still lacking evidence. Lastly, knowing the persuasive techniques used to influence a person's attitudes, opinions, or behavior is also useful from the recipient's perspective. It could even be beneficial in developing people's critical thinking and identifying how a persuasive attempt makes them feel through the state of affective arousal.

Method

Data Sources

The present review was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Moher et al., 2009). The search was performed in the Web of Science, Scopus, Embase, PsycINFO, and PubMed databases on articles that were published until September 2023. The following keywords were used in all databases: (argumentation* OR persuasion) AND cognition* AND emotions*; and: persuasion* AND (psychophysiology* OR psychobiology*). The search was not limited by any terms.

Eligibility

The titles, abstracts, and keywords of all the search results were evaluated. Relevant articles based on our aims were further examined in full text. The inclusion criteria were the following: (1) empirical articles; (2) studies evaluating persuasion appeals, either emotional or cognitive; (3) articles examining an individual's response to persuasion, either by self-report or by physiological reaction; (4) human participants; and (5) the English language. The exclusion criteria were: (1) theoretical articles, systematic reviews, and meta-analyses; (2) studies that did not analyze persuasive appeals, either emotional or cognitive; and (3) papers that exclusively employed neuroimaging methods. The third criterion was implemented because this systematic review focuses on examining responses to persuasion through psychophysiological measures, an area that remains underexplored in persuasion literature. In contrast, the neuroscience of persuasion, particularly the study of neural correlates using neuroimaging techniques, is a growing field with a significant body of research and reviews. This review aims to address the existing gap by concentrating on the psychophysiological responses to persuasion, an aspect that has yet to receive systematic exploration.

Data Synthesis

Data extracted from eligible studies were divided into four categories: (1) studies examining the effects of discrete emotions on information processing, (2) studies evaluating the moderating effect of affect- and cognition-based orientations on information processing, (3) articles examining the effects of framing on information processing, and (4) studies exploring the psychophysiology of persuasion.

Results

Literature Search

The systematic database search identified 302 articles. Of these, 79 articles were excluded for being duplicates, with 223 remaining (Figure 1). After reviewing titles and abstracts, 175 articles were excluded that did not meet the criteria and 48 were assessed in full text. Finally, 20 were eliminated for various reasons: for not describing persuasive appeals ($n = 4$); for examining types of argumentation, but not persuasion ($n = 2$); for dealing only with information processing or attitude formation, but not with persuasion ($n = 4$); for evaluating non-verbal communication ($n = 1$); for studying persuasion as the independent variable (the production of it) and not as dependent ($n = 1$); for being theoretical articles ($n = (2)$ and conference paper ($n = 1$); and for not offering access to full-text versions ($n = 5$). In total, 28 articles were included in the review (marked with the symbol (*) in the references section).

Studies Examining the Effects of Discrete Emotions in Information Processing

The effect of discrete emotions on information processing is examined in ten articles. Table 1 presents a summary of the results. Most articles include several studies: two articles include four or five studies, two articles include three studies, three articles include two studies, and the last three articles include one study. To analyze the effect of discrete emotions on the persuasion process, two of the ten articles compare happiness versus sadness as mediators of the persuasion process (Briñol et al., 2007; Sinclair et al., 2010), and one compared how positive or negative messages facilitate or constrain the persuasion process (*Muis et al., 2022).

Happy people tend to process a persuasive message using a cue, such as a likable source since it has the potential for mood maintenance; sad people, however, elaborate persuasive messages regardless of the likability of the source and have more positive attitudes toward strong arguments (Sinclair et al., 2010). *Muis et al., 2022 compared how positive and negative discrete emotions facilitate or constrain the persuasion process with the aim of increasing individuals' willingness to take preventive action regarding the COVID-19 pandemic. Results revealed that the positive persuasive text was more effective in increasing individuals' willingness to engage in preventive action, in social distancing and isolation, compared to the negative or control text

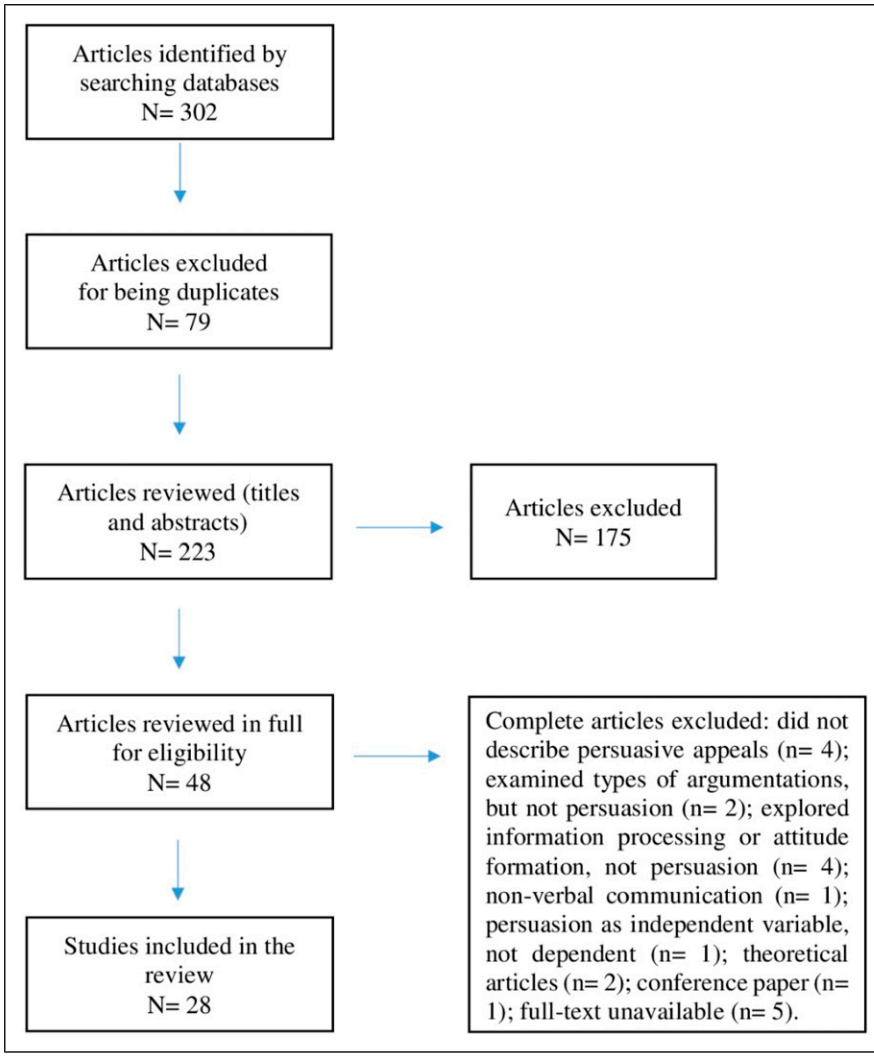

Figure 1. Flow of the identification and selection of studies.

condition. Moreover, results suggest that the effect can be extended to the actual preventive behavior.

The results by Briñol et al. (2007), with four different studies on the effect of emotions on evaluative judgments, confirm that the effect of emotions is mediated not only by the level of elaboration, but also by changes in thought confidence. For people low in NFC, their happy state and a mood-maintenance source act as a cue leading to

Table 1. Studies Examining the Effects of Discrete Emotions on Information Processing.

Authors (year)	Sample	Method	Results
Briñol et al. (2007)	**Study 1:** *N* = 92	IV: Argument quality (strong vs. weak); emotion induction (happy or sad); message focus (argument focus or control). DV: List of thoughts; attitudes; emotion manipulation check.	With the emotional induction after the message exposure, there is a larger argument quality effect for happy participants. Also, happy participants rely more on their thoughts (favorable or unfavorable) than those in the sad induction.
	Study 2: *N* = 89	IV: Argument quality; emotion induction. DV: Attitudes; thoughts; thought confidence; emotion manipulation check.	Thought confidence mediates the effects of emotion on judgment. Specifically, thought confidence via happiness (vs. sadness) leads participants to rely more on their thoughts.
	Study 3: *N* = 79	IV: Argument quality; emotion induction; NFC. DV: Thoughts; attitudes; thought confidence; emotion manipulation check.	*High in NFC*: The effect of thought confidence produces a greater argument quality effect on a happy state. *Low in NFC:* Emotion has a direct effect on judgment without confidence mediation; emotion acts as a simple cue, regardless of argument quality.
	Study 4: *N* = 78	IV: Argument quality; emotion induction (happy, sad, or neutral). DV: Behavioral intentions; emotion manipulation check; distraction.	Replicates previous results.
Briñol et al. (2018)	**Study 1:** *N* = 140	IV: Thought valence (positive vs. negative); emotion induction (anger vs. surprise); appraisal type (confidence vs. pleasantness). **[About the self]** DV: Attitudes; trait favorability.	*Confidence appraisal condition*: Anger increases the impact of thought valence on attitudes. = anger is associated with more confidence (than surprise). *Pleasantness appraisal condition*: Anger decreases the impact of thought valence on attitudes. = anger is a less pleasant emotion (than surprise).
	Study 2: *N* = 159	IV: Same as study 1. **[about others]** DV: Attitudes; thought favorability.	Same as study 1. Extending the contribution from self-attitudes to others.
	Study 3: *N* = 125	IV: Argument quality; emotion induction (anger vs. surprise); appraisal type. **[About health behavior]** DV: Same as study 2.	Same as previous studies. Extending the contribution from self and others' evaluations to a health-related topic.

(continued)

Table 1. (continued)

Authors (year)	Sample	Method	Results
	Study 4: *N* = 132	IV: Thought valence; appraisal type; emotion induction (disgust vs. surprise). DV: Attitudes.	Similar to previous studies but extending results to another emotion: Disgust. Confidence appraisal (cognitive information): Disgust validates thoughts. Disgust is associated with certainty (vs. Surprise). Pleasantness appraisal (affect-focused information): Disgust leads to less thought use. Disgust is associated with unpleasantness (vs. Surprise).
	Study 5: *N* = 258	IV: Thought valence; emotion induction (awe vs. anger); appraisal mode. DV: Attitudes; thought favorability; perceived validity.	Confidence appraisal: Anger leads to greater use of thoughts (vs. Awe). Pleasantness appraisal: Anger leads to less use of thoughts (vs. Awe). Replicates previous results.
Das et al. (2003)	**Study 1:** *N* = 184	IV: Vulnerability group (low or high); severity (low or high); argument quality. DV: Persuasion; negative affect; thought listing.	*High vulnerability* = more positive attitudes toward the action recommendation, regardless of severity and argument quality. *Severity of the health risk* = more severity leads to more positive attitudes toward the action recommendation, regardless of argument quality. *Low vulnerability* = motivates individuals to scrutinize arguments.
	Study 2: *N* = 111	IV: Vulnerability group; severity; argument quality; systematic processing instructions (present or absent). DV: Same as study 1.	*Argument quality*: More favorable attitudes when the recommendation is supported by strong arguments, and under conditions of *low vulnerability*.
	Study 3: *N* = 118	IV: Same as study 1. DV: Persuasion; negative affect.	*Severity*: Increases in severity have a greater impact on attitudes in the low vulnerability condition, regardless of argument quality. *Intention:* More intention to accept the action recommendation in the high vulnerability condition.
Dillard and Peck (2000)	**Study 1:** *N* = 140	IV: Heuristic condition (heuristic-enabled, heuristic-disabled, or natural);	No main effect for the heuristic condition. Each emotion causes a significant impact on attitudes.

(continued)

Table 1. (continued)

Authors (year)	Sample	Method	Results
		Order of presentation; exposures (8 PSAs/7 discrete emotions). DV: Affective responses; cognitive responses; perceived effectiveness; attitudes.	Positive association between perceived persuasiveness and attitude toward the issue. Effect of cognition and emotion on attitude is mediated by perceived persuasiveness.
	Follow up: *N* = 55	IV: Affective tone (positive or negative); exposures (2 PSAs); order of presentation. DV: Affective responses; perceived effectiveness; liking; attitudes.	Effectiveness is a more consistent predictor (relative to liking) of attitude toward the issue regardless of the affective tone of the message.
Griskevicius et al. (2010)	**Study 1**: *N* = 398 (249 W, 149 M)	IV: Emotion inductions (7: Anticipatory enthusiasm, amusement, attachment love, contentment, nurturant love, awe, and neutral/control); argument strength (strong vs. weak). DV: Attitudes.	Anticipatory enthusiasm, amusement, and attachment love facilitate heuristic processing. In contrast, awe and nurturant love led to more systematic processing.
	Study 2: *N* = 337 (175 W, 162 M) Mean age: 19.4	IV: Emotion inductions (5: Neutral, awe, nurturant love, amusement, and anticipatory enthusiasm); argument strength (weak). DV: Attitudes; appraisal dimension ratings; thought listing.	*Mediation effect*: Different positive emotions are mediated by different cognition processes. *High-responsibility appraisals:* Predict greater persuasion and a bias toward favorable thoughts. *Anticipatory enthusiasm:* Has a bias toward favorable thoughts.
Karsh and Eyal (2015)	**Study 1a**: *N* = 106 (67 W, 39 M) **Study 1b:** *N* = 147 (82 W, 65 M) **Study 2:** *N* = 166	IV: Construal-level manipulation (high or low); emotional manipulation (pride or joy). DV: Attitudes./Study 1b: Attitudes and intentions. IV: Construal-level manipulation: (Superordinate or subordinate); emotional manipulation (pride or joy). DV: Willing to contribute (WTC).	*High-level construal* (temporal distance) = the consideration of pride leads to more persuasion than joy. WTC was greater following the consideration of a pride-eliciting event (vs. joy) and in a superordinate category.

(continued)

Table 1. (continued)

Authors (year)	Sample	Method	Results
*Muis et al., 2022	*N* = 1078 (who completed the first and the follow-up surveys)	IV: Text condition (negative, positive, or control text) DV: Self-reports: COVID-19 concern, emotions about the pandemic, willingness to engage in preventive action, and 1-week later actual preventive action.	*Willingness to engage in preventive action*: The positive persuasive text increased the willingness to engage in preventive action, compared to the control or negative text condition. *Actual preventive action:* Also, the positive persuasive text increased individuals' engagement in preventive action one week later, compared to the control or negative text condition. In addition, emotions mediate the relationship between the willingness to engage in preventive action and the actual preventive action.
Sinclair et al. (2010)	**Study 1:** *N* = 77 (60 W, 17 M)	IV: Source likability (likable or dislikable); mood induction (happy or sad); argument strength. DV: Argument evaluation; list of thoughts.	*Sad mood induction*: Elaborates persuasive messages regardless of the likability of the source. *Happy mood induction*: Elaborates only when the source of the arguments is likable.
	Study 2: *N* = 91 (54 W, 37 M)	IV: Source likability; mood induction (happy); cognitive load (present or absent); argument strength. DV: Argument evaluation; attitudes.	*Cognitive load and happy mood induction:* Equally persuaded by strong or weak arguments from a likable source. With no message elaboration, source likability serves as a cue to process.
Turner et al. (2020)	*N* = 267 (174 W, 93 M) Mean age: 20.10	IV: Anger (high vs. low); efficacy (high vs. low); argument quality. DV: Thought listing; behavioral intentions.	*High anger and high efficacy*: Increase systematic processing and lead to greater intentions to engage in activism, after processing strong arguments. *High anger and low efficacy:* Less likely to engage in activism, even when presented with strong arguments.

(continued)

Table 1. (continued)

Authors (year)	Sample	Method	Results
Worsdale and Liu (2023)	*N* = 326 All women. Mean age: 19.03	IV: Narrative versus non-narrative messages; hope versus fear appeals in the narrative condition. DV: Self-efficacy; positive emotional response; Individual's readiness to change; behavioral intention.	Narrative messages were not more effective at increasing behavioral intention to get the endometriosis screening than non-narrative messages. No significant differences between fear and hope appeal conditions were observed in self-efficacy or behavioral intention. A significant difference between the two conditions was observed in the positive affect response. Individuals in the hope appeal condition experienced greater positive affect. In addition, positive affect mediates the relationship between types of emotional appeal and intention.

Abbreviations. DV: dependent variables; IV: independent variables; M: men; N: sample group; PSA: public service announcement; W: women; NFC: need for cognition; WTC: willing to contribute.

positive attitudes but with more heuristic processing and no distinction in argument quality. However, individuals high in NFC and happy report more confidence in their thoughts and have more favorable attitudes toward strong arguments. Emotion induction mostly consisted of asking participants to think and write about either happy or sad personal experiences (Briñol et al., 2007), to read happy or sad statements extracted from Velten's (1968) procedure (Sinclair et al., 2010), or framing messages negatively (number of deaths) or positively (saving lives) (*Muis et al., 2022).

Three articles evaluate the difference in emotions of the same valence (Dillard & Peck, 2000; Griskevicius et al., 2010; Karsh & Eyal, 2015). Griskevicius et al. (2010) argue that happy people rely more on systematic or heuristic processing depending on what type of positive emotion is experienced, as each emotion has a different function. Karsh and Eyal (2015) compare *pride* and *joy*, both positive emotions, but with different effects due to the differences in their level of construal (i.e., abstractness) and perspective (near vs. distant). Pride is temporally distant and abstract, while joy is proximate and more concrete. As a result of this difference, pride promotes more elaborative processing and persuasion. Dillard and Peck (2000) support the benefits of examining the specific signals tied to each emotion and not only the dimension of the valence (whether it is positive or negative). For example, they observe that positive emotions like happiness and contentment have unique effects. While happiness is

associated with increased message acceptance, contentment is associated with an uncritical rejection of the stimulus. Some of the strategies used in these articles to elicit emotions were presenting public service announcements about different topics (Dillard & Peck, 2000); asking participants to write about a personal experience related to a specific emotion, or reading a provided cover story (Griskevicius et al., 2010); and imagining a future hypothetical emotional event (Karsh & Eyal, 2015), among others.

Two articles focus on anger appeals: one studies the role of self-efficacy beliefs in the context of student protests (Turner et al., 2020) and the other examines the consequences of appraisals on the validation of thoughts after the experience of four different emotions, namely, anger, disgust, surprise, and awe (Briñol et al., 2018). Specifically, Briñol et al. (2018) study the implications of the pleasantness/unpleasantness and confidence/doubt appraisals. These authors state that some pleasant (unpleasant) emotions are accompanied by the feeling of certainty or confidence and others by the feeling of uncertainty or doubt. The results are consistent across five studies and suggest that in the confidence appraisal, the emotions of anger and disgust validate the subject's thoughts even though they are unpleasant; in the pleasantness appraisal, however, the emotions of surprise and awe validate the subject's thoughts even though they are associated with doubt. The results obtained by Turner et al. (2020) suggest that the emotion of anger leads individuals to more systematic processing of arguments only when they have a high self-efficacy belief in their ability to engage in the appropriate course of action. Considered jointly, the emotion of anger validates people's thoughts (Briñol et al., 2018) or beliefs about themselves. High anger paired with high efficacy beliefs increases argument quality distinction, while high anger paired with low efficacy beliefs reduces their processing ability.

The last two of the ten articles examine fear appeals through the communication of the health consequences of stress (Das et al., 2003), and the promotion of endometriosis screening (Worsdale & Liu, 2023). In Das et al. the participants' vulnerability, the severity of the health consequences, and the argument quality were manipulated. The results reveal that a high level of severity (i.e., of fear appeal) leads to a more positive attitude toward the action recommendation. Specifically, when the participants feel high vulnerability toward the health consequences, positive attitudes increase for the action recommendation. But, when they feel low vulnerability, even when the severity is high, they feel more motivated to scrutinize the arguments.

In contrast, Worsdale and Liu (2023) found that the use of positive emotional appeals (e.g., hope appeals) instead of negative emotional appeals (e.g., fear appeals) in narrative health messages is more effective in increasing positive affect following message exposure. No significant differences were observed between the hope and fear appeals in the subsequent behavioral intention. However, through an indirect effect of hope appeal, positive affect mediates the relationship between the type of appeal and the behavioral intention so that hope appeal increases the positive affect which in turn increased the screening intentions.

Studies Examining the Moderating Effects of Affect- and Cognition-Based Orientations on Information Processing

Six articles focus on the effect of the argument's affective or cognitive contents on information processing. Two articles include three studies, one includes two studies, and the remaining three articles include one study each. Table 2 presents a summary of the results.

Two articles compare how the matched or mismatched effects between the recipient and the stimulus influence persuasion processes. Huntsinger (2013) evaluates the effect of affective coherence or incoherence on information processing and thought confidence in three experiments. Affective coherence occurs when the elements of the emotional experience are in harmony, whereas affective incoherence occurs when happy feelings are accompanied by sad thoughts (Huntsinger, 2013), or the other way around; it depends on the match effect and on the order of presentation of the stimuli. The experience of affective coherence produces superficial processing with no effect of argument quality, while the experience of affective incoherence produces more detailed processing and a greater effect of argument quality. The manipulation of the timing influences thought confidence. If the participants read the arguments before emotional induction, the affective coherence experience validates the thoughts generated while reading the arguments; the experience of affective incoherence, however, invalidates the thoughts.

Keller and Block (1999) reported affect- and cognition-based dissonance, which is like a further division of the incoherence experience mentioned above. Affect-based dissonance and cognition-based dissonance produce two types of dissonance-reducing strategies. Cognition-based dissonance leads to less denial, more refutation, and more pertinent thinking, with a tendency to judge the message as lower in quality and less persuasive (Keller & Block, 1999). People trying to reduce affective-based dissonance tend to undermine the message, with higher message denial and less pertinent thinking. Both contrast with the coherence or the match effect, in which people tend to judge the information as more credible.

In Dubé and Cantin (2000), results support the hypothesis that the persuasive efficacy of communication depends on the attitude toward the focal item (affective or cognitive) and the desired behavioral outcome (consumption change or liking). The topic of the experiment is milk consumption. The emotional appeals of the persuasive statements are more influential for food liking, whereas the informational/cognitive appeal is more influential for inducing a consumption change. Particularly, there is a matching effect between the affective responses of the subjects (food liking) and the persuasive attempt with emotional appeals. Naimi et al. (2023) compared the effectiveness of emotional or cognitive appeals to increase the likelihood of entrepreneurs to source funding for their business from lenders through prosocial crowdfunding platforms. Results revealed that cognitive appeals attract more resources than emotional appeals, with the use of negative emotional frames correlating negatively to the average amount of funding.

Table 2. Studies Examining the Moderating Effects of Affect- and Cognition-Based Orientations on Information Processing.

Authors (year)	Sample	Method	Results
Appel and Maleckar (2012)	Study 1: *N* = 135 (88 W, 47 M) Mean age: 22.31	IV: Paratextual labels (non-fiction, fiction, or fake). DV: NFC; NFA; expectations.	*Non-fiction*: Perceived as more trustworthy and useful. *Fiction*: Participants expect to be more immersed (entertained and transported). *Fake*: Receives the lowest trustworthiness and usefulness ratings. No relation between NFA, NFC, and the paratext dimensions.
	Study 2: *N* = 186 (108 W, 78 M) Mean age: 31	IV: Stories; paratext conditions (non-fiction, fiction, fake, or control story). DV: Transportation; beliefs; NFC; NFA.	Fiction condition more persuasive than fake condition. Fake condition has the lowest scores in transportation. The higher the NFA, the larger the persuasive impact of a story. The higher the NFC, the lower the belief scores in the fake condition.
Dubé and Cantin (2000)	*N* = 95 (89W, 6 M) Mean age: 23	IV: Attitude basis (affect-based or cognition-based); type of appeal (informational or emotional). [About milk consumption] DV: Milk liking; consumption change intent; immediate feeling responses; immediate thought responses.	Affect-based participants: Consumption change intent: The informational appeal is more effective. (Cognitive response) Liking: The emotional appeal is more effective. (Affective response). There is a matching effect on affect-based participants, not in cognition-based participants.

(continued)

Table 2. (continued)

Authors (year)	Sample	Method	Results
Haddock et al., 2008	**Study 1:** *N* = 24 (16 W, 8 M) Mean age: 19.8	IV: Message type (affect vs. cognition); information preference (affect vs. cognition). [About a beverage] DV: Attitudes.	Affect-based messages lead to more positive attitudes in individuals high in NFA. Cognitive-based messages produce more positive attitudes in individuals high in NFC.
	Study 2: *N* = 50 (45 W, 5 M) Mean age: 20	IV: Message type; information preference. [About a fictional animal] DV: Attitudes.	Individual differences in NFA and NFC influence receptivity to affect-based and cognition-based messages.
	Study 3: *N* = 58 (52 W, 6 M) Mean age: 19.5	IV: Same as study 2. DV: Recognition task.	Higher in NFA is associated with greater recognition of affect-based messages. Higher in NFC in turn is associated with greater recognition of cognition-based messages.
Huntsinger (2013)	Study 1: *N* = 109 (81 W, 28 M)	IV: Mood manipulation (positive vs. negative) [before arguments]; priming (a lexical decision task: with happy or sad words); argument quality. DV: Attitudes.	*Affective coherence*: Equally persuaded by strong and weak arguments. Superficial processing. *Affective incoherence*: More persuaded by strong arguments. More detailed processing.
	Study 2: *N* = 206 (139 W, 67 M)	IV: Same as study 1, except for the order. Arguments before mood manipulation and priming. DV: Thought confidence; attitudes.	*Thought confidence*: Those experiencing affective coherence reported more confidence in their thoughts than those in the affective incoherence condition.

(continued)

Table 2. (continued)

Authors (year)	Sample	Method	Results
	Study 3: *N* = 213 (146 W, 64 M)	IV: Manipulation of the timing./Mood manipulation (happy) [either before or after arguments]; priming (happy or sad); argument quality. DV: Thoughts; attitudes.	*Induction before reading the arguments*: There is a greater effect of argument quality on the affective incoherence condition. *Induction after reading the arguments*: In contrast, the effect of argument quality is more pronounced on the affective coherence condition.
Keller and Block (1999)	*N* = 93 All women.	IV: Prior intentions (low vs. high); manipulation of fear arousal (high vs. low). [About safe sex and the use of condoms] DV: Thoughts (supportive vs. refutation); persuasion (behavioral intention); affect scale; cognitive scale; message quality.	High prior intentions: More supportive thoughts and more persuaded (vs. Low prior). Low fear condition: More refutation thoughts (vs. High fear). Low prior intentions and high-fear appeal = affect-based dissonance. High prior and low fear = cognition-based dissonance.
Naimi et al. (2023)	*N* = 2098 entrepreneurs	IV: Entrepreneurial narratives (type of appeal: Cognitive or emotional); psychological elements (positive emotions, negative emotions, cognitive words) DV: Loan amount (average amount of funding sourced per day)	In a prosocial crowdfunding setting, cognitive appeals attract more resources than emotional appeals. In addition, negative emotional frames were negatively related to the average amount of funding sourced per day, while positive emotions had no significant relationship with the amount of funding. Female entrepreneurs and groups of entrepreneurs source a higher average amount of funding than male entrepreneurs and individual entrepreneurs.

Abbreviations. DV: dependent variables; IV: independent variables; M: men; N: sample group; NFA: need for affect; NFC: need for cognition; W: women.

Lastly, two articles evaluate the effect of NFA and NFC on the argument elaboration (Appel & Maleckar, 2012; Haddock et al., 2008). As has been documented in the literature and previous articles in this section, a persuasive message induces more attitude change when the arguments match the recipient's initial attitude, which in many studies is created or induced it. However, in Haddock et al. and Appel and Maleckar's articles, they study the matching effect between the messages's affective or cognitive content with individual differences based on the personality traits of NFC and NFA. Results suggest that individuals high in NFA become more persuaded and have more positive attitudes toward affect-based messages. In contrast, individuals high in NFC are more persuaded and have more positive attitudes toward cognition-based messages. Appel and Maleckar (2012) report that NFC and NFA influence the processing of paratextual information in narrative persuasion. For individuals high in NFC, a fake story is less persuasive than a fictional or non-fictional story, while individuals high in NFA develop strong beliefs for the story itself regardless of whether the frame type is true or false. These results provide evidence of the moderating effects of NFC and NFA as individual characteristics on message processing.

Studies Examining the Effects of Framing on Information Processing

Five articles examine the effects of framing on persuasion, particularly on affective and cognitive responses. One of the articles includes three studies, two articles include two studies, and the last two articles include one study each. Table 3 presents a summary of the results.

Two articles evaluate how affective and cognitive message frames, such as "feel" and "think," change attitudes (Mayer & Tormala, 2010; Ryffel & Wirth, 2016), and also consider differences based on gender. Another article explores how individual differences in age, NFC, and affective intensity (AI) interact and moderate framing effectiveness (McKay-Nesbitt et al., 2011). Results suggest affective messages are more successful in changing affect-based attitudes, while cognitive messages are more successful in changing cognitive-based attitudes (Ryffel & Wirth, 2016), which is a matching effect driven by message frames. Regarding gender, Mayer and Tormala (2010) find women are more persuaded by feel-framed messages and men by think-framed messages. Concerning age, younger adults recall more units of a message when it is emotionally framed (vs. rational), whereas older adults have more positive attitudes toward rational-appeal frames (vs. emotionally negative appeals) (McKay-Nesbitt et al., 2011).

The last two articles examine the effect of framing on persuasive health messages (Shen, 2010; Shen & Dillard, 2007). In Shen and Dillard (2007), out of several measures, participants respond to affective close-ended scales about their emotional reactions to the messages, which are later associated with the behavioral inhibition system (BIS), and the behavioral approach system (BAS). BIS was expected to correlate with negative emotions and BAS with positive emotions. The results show positive associations between BIS and disgust, anger, fear, and sadness and between

Table 3. Studies Examining the Effect of Framing on Information Processing.

Authors (year)	Sample	Method	Results
Mayer and Tormala (2010)	**Study 1:** *N* = 65	IV: Affective-cognitive orientation; message frame (feel or think). DV: Behavioral intentions.	Affective-orientation condition: Participants have more favorable behavioral intentions in the feel condition (vs. Think). Cognitive-orientation condition: In contrast, participants have more favorable behavioral intentions in the think condition.
	Study 2: *N* = 75	IV: Prime (affective vs. cognitive) [both negative]; message frame. DV: Attitudes; processing fluency; involvement.	Attitudes: In the cognitive-prime condition, the second message is more persuasive if there is a matching effect, i.e., if it is framed in think. The same effect on the affective-prime condition. Processing fluency: Participants process the second message more easily if there is a matching effect between the priming and framing condition. Involvement: No significant effect.
	Study 3: *N* = 74	IV: Message frame; gender. DV: Attitudes; message perceptions; emotional orientation.	Gender: Male participants reporte more favorable attitudes toward the think framing and women toward the feel framing. Message perceptions: Men rate the messages as more convincing and less doubtful (vs. Women). Emotional orientation: Women classify themselves as more emotional (vs. Men).

(continued)

Table 3. (continued)

Authors (year)	Sample	Method	Results
McKay-Nesbitt et al. (2011)	Younger adults: *N* = 151 (77 W, 74, M) Mean age: 20 Older adults: *N* = 124 (84 W, 40 M) Mean age: 70	IV: Age; affective intensity (AI) (high vs. low); NFC (high vs. low); appeal frame (rational, negative-emotional, positive-emotional). DV: Ad recall; involvement; attitudes; verbal ability (WAIS).	*Younger adults*: Emotional appeals are more persuasive, and they remember them better than rational appeals./ Negative appeals are more persuasive than positive appeals. *Older adults*: More positive attitudes toward rational appeals than emotional appeals./Positive appeals are more persuasive than negative appeals. High in NFC individuals report more involvement, attitudes, and recall, regardless of age, than those low in NFC.
Ryffel and Wirth (2016)	*N* = 189 (131 W, 58 M) Mean age: 21.17	IV: Attitude induction (affective or cognitive); framing (affective or cognitive); persuasion strength (weak or strong). DV: Attitude basis; attitude change; processing fluency.	Attitude change: Strong persuasive appeals are more effective in changing attitudes (vs. Weak). Processing fluency: "Mediates the effect of message matching on attitude change for strong and weak persuasion appeals" (p.59).
Shen (2010)	*N* = 315 (195 W, 120 M) Mean age: 19.78	IV: Message frame (health consequence, secondhand smoke, and industry manipulation); message sequence (4 PSAs). [About anti-smoking] DV: Discrete emotions; cognitive responses (thoughts); message sensation value; attitudes; smoking behavior.	In general, message frames influence cognitive and affective responses. Affective responses (7 discrete emotions): *Health consequences*: Lead to more surprise, fear, sadness, disgust, and guilt. *Secondhand smoke*: Causes more fear and happiness. *Industry manipulation*: Leads to more anger, and guilt.

(continued)

Table 3. (continued)

Authors (year)	Sample	Method	Results
Shen and Dillard (2007)	**Study 1:** *N* = 286 (209 W, 77 M) Mean age: 20	IV: Framing (advantage vs. disadvantage). DV: Affective responses; cognitive responses; BIS and BAS scales; attitudes; behavioral intentions.	Advantage framing: Produces positive emotions. Disadvantage framing: Produces negative emotions. BIS: Positive associated with disgust, anger, fear, sadness, and surprise. BAS: Associated with fear. Not with happiness, as was expected.
	Study 2: *N* = 252 (179 W, 73 M) Mean age: 20.29	IV: Same as study 1. DV: Same as study 1, and message sensation value.	Replicates previous results. Advantage framing influences BAS activation, whereas… Disadvantage framing causes BIS activation.

Abbreviations. AI: affective intensity; BAS: behavioral approach system; BIS: behavioral inhibition system; DV: dependent variables; IV: independent variables; M = men; N = sample group; NFC: need for cognition; PSA: public service announcement; W = women.

BAS and fear; the latter was not expected, as fear is not a positive affect emotion. Shen (2010) examines message frames in anti-smoking public service announcements considering three frames: health consequences, secondhand smoke, and industry manipulation. Overall, the three message frames cause negative emotions, probably due to the unpleasant topic. However, the emotion of fear predicts the attitude toward smoking in two of the three message frames, health consequences, and secondhand smoke.

Studies Exploring the Psychophysiology of Persuasion

Seven articles examine the psychophysiological processes of persuasion. The results of the studies are summarized in Table 4.

One article researched whether narrative persuasion could influence donation behavior (Correa et al., 2015). There are two groups and versions of the narrative: The most-just versus the least-just version. Some of the measures used to compare both groups are Electroencephalography (EEG), electrocardiography (ECG), donation behavior, and affective state, among others. Overall, there are no differences between the groups in donation behavior, or in the engagement values extracted from the EEG or heart rate (HR) from the ECG; however, there is a significant difference in heart rate

Table 4. Studies Exploring the Psychophysiology of Persuasion.

Authors (year)	Sample	Method	Results
Clayton (2022)	*N* = 100 75% W Mean age: 20.36	IV: Four anti-vaping PSAs; message condition (dogmatic vs. suggestive). DV: Threat to freedom; state psychological reactance; behavioral intentions; self-reported arousal and valence; recognition memory; physiological responses (HR, SCL, EMG-CS).	Users in the dogmatic anti-vaping PSA condition self-reported greater freedom threat, psychological reactance, intention to use e-cigarettes, and unpleasantness than users in the suggestive condition. Physiological responses: Also, users in the dogmatic anti-vaping PSA condition had greater corrugator muscle activation, SCL, and HR acceleration. Recognition memory: Lower for participants in the dogmatic condition than those in the suggestive anti-vaping PSA condition.
Correa et al. (2015)	*N* = 49 (28 W, 21 M) Mean age: 40.7	IV: Narrative (least just vs. most just). DV: Attention (engagement and workload- EEG); emotions (HR and HRV- ECG); post-narrative questionnaire; donation behavior; self-report measures: BDI, STAI, IPIP-NEO PI-R, IRI.	Donation behavior: No differences between the least- versus most-just version, and donation behavior. Affective state: Those who view the least-just version experience a more negative affective state. Specifically, among those who donated. HRV: Those who do not donate have a significantly greater HRV, regardless of narrative version. And no differences in the affective state. Self-report: Those who donate have a higher IRI, morality, sympathy, and dutifulness.
*Spelt et al., 2018	*N* = 56 Mean age: 48	IV: Persuasion principles (authority, scarcity, commitment, and social proof). DV: Past behavior and attitude; STPS; arousal (ECG).	Cardiovascular arousal and STPS: A significant negative correlation between the authority principle and reactivity in IBI. Lower susceptibility to authority - > higher IBI. Cardiovascular arousal and persuasion principles: Significant difference during persuasive principles compared to baseline or startle response in IBI and SDNN. No differences between different persuasion principles.

(continued)

Table 4. (continued)

Authors (year)	Sample	Method	Results
Spelt et al. (2019)	*N* = 56 Mean age: 24	IV: Persuasive messages (high vs. low controlling language) (HCL vs. LCL). DV: Motivational state; attitudes; intentions; psychological reactance; ECG; EDA.	Persuasive messages: Neither HCL nor LCL persuade participants to change attitude, but they are more reactant in the HCL condition. Physiological measures and persuasive messages: Significant difference during persuasive messages ↑ versus rest state ↓ in ECG.
Spelt et al. (2022a)	*N* = 70	IV: Persuasive video advocating the limit of meat consumption; group (M: medium meat consumption, and H: High meat consumption). DV: Self-reports: Demographics, initial motivational states, and after video survey; EDA (SCL and SCRs); ECG (HR and HRV).	Time (before/after video): Lower scores before the video for moral beliefs, perceived behavioral control, and reduction intention than after. Consumption patterns: Lower reduction intention in the high meat consumers group than the medium consumers, both before and after the video. Physiologic data: During the video, lower RMSSD and SDNN, and higher SCRs compared to baseline./ During the survey, higher HR, RMSSD, SDNN, and SCL, and lower SCRs compared to the video. No effect of group was found in the physiologic data. Initial motivational state variables explained variance in physiological reactivity parameters (except for SDNN).
Spelt et al. (2022b)	*N* = 75 Mean age: 40	IV: Persuasive messages (gain- or loss-framed). DV: Pre- and post-attitudes and intentions; motivational orientation (BIS/BAS scales); behavioral compliance; ECG; EDA; RR; facial EMG.	Message frame: Loss-framed messages are more effective in general. Short-term persuasion (attitude and intention): Significant increase in instrumental and affective attitude, and intention from before to after the intervention. Long-term persuasion (behavioral compliance): No changes in behavior or attitudes two weeks later. Physiological measures: Significant difference during persuasive messages compared to rest state in HR, RR, EMG-CS, and SCR. No differences between conditions.

(continued)

Table 4. (continued)

Authors (year)	Sample	Method	Results
Spelt et al. (2022c)	*N* = 56 Mean age: 48	IV: Persuasion principles (authority, scarcity, consensus, and commitment). DV: Past behavior and attitude; TIPI; STPS; ECG; EDA; RR; facial EMG.	Physiological measures and persuasion principles: Significant difference during persuasion principles versus rest. No differences between different persuasion principles. STPS: Explains variance in reactivity of SCL, SCR, ZM, and CS. Lower susceptibility - > higher physiological reactivity, and vice versa.

Abbreviations. PSA: public service announcement; HR: heart rate; HRV: heart rate variability; IBI: inter-beat interval; SDNN: standard deviations of normal-to-normal heart rate; BDI: beck depression inventory; STAI: state trait anxiety inventory; IPIP-NEO PI-R: international personality item pool representation of the NEO personality inventory-revised; IRI: interpersonal reactivity index; STPS: susceptibility to persuasion scale; TIPI: ten-item personality inventory; ECG: electrocardiography; EDA: electrodermal activity; SCL: skin conductance level; SCR: skin conductance response; RR: respiration rate; EMG; electromyography; EMG-ZM: zygomaticus major; EMG-CS: corrugator supercilii; HCL: high controlling language; LCL: low controlling language; BIS/BAS: behavioral inhibition/behavioral activation system.

variability (HRV) and affective state. An increase in overall HRV is observed in those who do not donate as opposed to those who do, while those who donate and viewed the least-just version experience a more negative affective state.

Two articles explore different physiological measures—cardiovascular arousal (*Spelt et al., 2018), respiratory rate (RR), electrodermal activity (EDA), and facial electromyography (fEMG) (Spelt et al., 2022b)—in response to four of the six persuasion principles proposed by Cialdini (2007): authority, scarcity, commitment, and consensus. Results suggest there is no significant difference in physiological reactivity during different persuasion principles, but rather between the exposure to persuasion compared to a baseline or startle period (*Spelt et al., 2018, 2022b). Both studies also find susceptibility to persuasion assessed using the susceptibility to persuasion scale (STPS) (Kaptein, 2012) helps to explain variance in some of the physiological parameters, such as in the inter-beat interval (IBI) (*Spelt et al., 2018), standard deviation from normal-to-normal peaks (SDNN), skin conductance level (SCL), skin conductance responses (SCR), zygomaticus major (EMG-ZM), and corrugator supercilii (EMG-CS) (Spelt et al., 2022b). Lower susceptibility to some principles appears to be related to a higher physiological reactivity and vice versa.

Three articles compare different message frames, high versus low controlling language (Spelt et al., 2019), gain- versus loss-framed persuasive messages (Spelt et al., 2022c), and dogmatic versus suggestive anti-vaping public service announcements (PSAs) (Clayton, 2022). Neither of them persuaded participants to change their

behavior (i.e., limit meat consumption, change oral health care behavior in the long term, or quitting the use of e-cigarretes). However, persuasive manipulation was successful in changing people's motivational state (Clayton, 2022; Spelt et al., 2022c) and level of reactance (Clayton, 2022; Spelt et al., 2019). The latter is assessed through self-report measures, ECG, EDA, and EMG. Specifically, in Clayton (2022), daily e-cigarette users in the dogmatic anti-vaping PSA condition had a greater level of reactance evidenced by greater self-reported freedom threat and intention to continue the use of e-cigarettes than the users in the suggestive anti-vaping PSA condition. The greater psychophysiological reactance in the dogmatic versus suggestive condition was also revealed with an increase in the SCL and corrugator muscle activation, HR deceleration and worse recognition memory, indicating there was a greater activation of the aversive motivational system.

Lastly, Spelt et al. (2022a) presented a persuasive video advocating the limit of meat consumption while measuring the physiological activity, with the aim to explore how the misalign between people's initial motivations and the topic reflects in their physiological response. The persuasive attempt was successful in changing some of the motivational states measured, such as moral belief, perceived behavioral control and reduction intention after watching the video. Moreover, the physiological arousal was explained by initial motivations, as higher reduction intention prior to the video was related to a lower arousal. In contrast, participants with greater misalignment between their current behaviors (about meat consumption) and the persuasive attempt (advocating vegetarianism) experienced more arousal in all the physiological parameters measured (i.e., cardiovascular and electrodermal activity).

Discussion

This study aimed to review the existing data about the relationship between emotions and persuasion, the principal moderator factors in such interaction, and the psychophysiological substrates. For this, we described and analyzed the findings of the effect of discrete emotions and the principal variables that moderate between emotions and the extent of the persuasive elaboration. Lastly, we gather the existing data about the physiological reactions to persuasion (e.g., reactance).

From a valence-based approach, findings suggest positive emotions (e.g., hope, or empathy) can be more persuasive in engaging individuals to follow an action recommendation through the increase of positive affect (*Muis et al., 2022; Worsdale & Liu, 2023). Positive emotions such as happiness, anticipatory enthusiasm, amusement, and attachment love facilitate more heuristic processing in which individuals use a cue to understand and establish their attitudes (Griskevicius et al., 2010; Mackie & Worth, 1991). However, the cue itself motivates individuals to engage in more systematic processing if there is another factor (e.g., high in NFC) that moderates the relationship and the level of argument elaboration is high (Petty et al., 1993); thus, individuals become more persuaded by strong (vs. weak) arguments (Sinclair et al., 2010).

As for negative emotions, they are typically associated with the systematic processing of information, and they are also mediated by various cognitive processes. A negative emotion like sadness tends to signal that a situation is problematic, causing more attentive and systematic processing, and more positive attitudes toward strong arguments (Sinclair et al., 2010). Since sad individuals do not benefit from a mood-maintenance cue, they tend to engage in deeper message scrutiny. Thus, from a motivational perspective, peripheral cues like source attractiveness have little impact because they have little to contribute to the attempt to form an informed opinion (Sinclair et al., 2010).

Beyond the emotional valence, results in the collected data revealed the principal factors that influence persuasion elaboration, as is: personal motivation (e.g., mood maintenance, or issue involvement) (Sinclair et al., 2010), NFC and NFA (Haddock et al., 2008), thought confidence (Briñol et al., 2007; Huntsinger, 2013), appraisal approach (Briñol et al., 2018; Smith & Ellsworth, 1985), level of construal (Karsh & Eyal, 2015), self-perceived vulnerability (Das et al., 2003), and efficacy beliefs (Turner et al., 2020), among others. Regarding the latter ones, both self-perceived vulnerability and efficacy beliefs are important mediators between emotion and behavioral outcome. When individuals feel high vulnerability, they have more positive attitudes toward the action recommendation regardless of the quality of the arguments (Das et al., 2003). It seems they try to undermine the negative aspects of the threat and process the positive aspects as more efficient and persuasive. This is similar to the positive bias in the anticipatory enthusiasm emotion (Griskevicius et al., 2010), which makes it plausible for a person who feels vulnerable to a threat to also feel this type of emotion to an action recommendation as it represents a potential benefit. In contrast, when the vulnerability is low, there is an increase in the motivation to scrutinize the arguments (Das et al., 2003), lower persuasion, and lower intentions to engage in the action recommendation, a similar reaction described as a *cognitive-based dissonance-reducing strategy* (Keller & Block, 1999).

In this line, the effectiveness of fear appeals continues to produce inconsistent results in the literature. In this review, some studies found that fear appeals are more effective in engaging individuals to follow the action recommendation (Das et al., 2003) and that it is positively associated with BAS (Shen, 2010; Shen & Dillard, 2007), while other found that fear appeals were less effective than a positive emotion such as hope, to increase positive affect and behavior intention (Worsdale & Liu, 2023). More recently, increasing positive affect have been considered in health communication research as an effective way to persuade behavioral intentions (Fitzgerald et al., 2019). In addition, this apparent contradiction emphasizes that cognition mediates the effect of emotions on persuasion.

Moreover, findings demonstrate the influence of recipients' orientation, either affective or cognitive, on their message processing (i.e., matching effect) (Dubé & Cantin, 2000; Haddock et al., 2008; Mayer & Tormala, 2010; Ryffel & Wirth, 2016). The matching effect can be studied by tailoring a message frame with the recipient's attitude bases (Petty & Wegener, 1998), or individual tendencies (Haddock et al., 2008). In

general, there are some discrepancies in the literature about whether the matching effect produces more persuasion either by a central route enhancing message scrutiny (Petty & Wegener, 1998) or by a peripheral route increasing processing fluency (Lee & Aaker, 2004). Ryffel and Wirth (2016) find that matching a message with a recipient's attitude bases heightens the processing fluency, thus serving as a peripheral cue. However, if the message is particularly strong, it triggers a mismatching effect and produces higher scrutiny (Ryffel & Wirth, 2016). This result contrasts with the findings of Petty and Wegener (1998), who state that weak arguments are the ones that can disrupt the fluency in the matching effect. Although in apparent opposition, both findings support the idea that the type of processing route transited, either central or peripheral, is affected firstly, by the dispositional state of elaboration (i.e., lower, or higher elaboration) and, secondly, by the strength of the argument. The extent of message elaboration depends on the individual's motivation and ability to think. Individuals constrained to be low in their thinking will transit the peripheral route regardless of the quality of the message, whereas individuals with a higher level of elaboration will more likely be engaged in scrutinizing the message, so its strength becomes more relevant (Teeny et al., 2020). Matching effects also increase message recognition, which suggests deeper information processing and differences in message elaboration (Haddock et al., 2008).

Other individual characteristics that moderate the effectiveness of message framing are gender (Mayer & Tormala, 2010) and age (McKay-Nesbitt et al., 2011). Overall, results suggest women and younger adults are more persuaded by emotionally framed messages. Mayer and Tormala (2010) report that women are more emotionally oriented than men, and thus more persuaded by feel-framed arguments. However, Cacioppo and Petty (1982) find that NFC does not vary as a function of gender. Perhaps the differences in the processing of message frames may be due to the individual's self-perception of the issue or tendency for NFC or NFA, irrespective of gender. Regarding age, younger adults recall emotionally negative messages better than rational ones, while older adults prefer positive and rationally framed messages. Nevertheless, very few studies consider the gender and age variables, which are relevant for distinguishing persuasive elaborations by groups.

Lastly, with respect to the psychophysiology of persuasion, findings are still very scarce. However, there is growing interest in the use of physiological measures to complement traditional predictors of persuasion and help explain variance in the motivational state and behavior of an individual caused by persuasive messages. Findings indicate differences in reactivity by higher HR (Spelt et al., 2019, 2022b, 2022c), lower SDNN (Spelt et al., 2022b), more RR (Spelt et al., 2022c), more frowning in EMG-CS (Spelt et al., 2022b, 2022c), and more SCRs (Spelt et al., 2022b, 2022c) during the processing of persuasive messages compared to a rest state, regardless of message framing. These results were also replicated in a study conducted in our laboratory where cardiovascular reactivity during persuasion was higher than baseline reflected in lower RMSSD (Omitted for confidentiality et al., submitted for publication). Interestingly, studies were consistent in finding that a greater misalignment between initial behavior and the persuasive attempt led to a defensive message

processing reflected in more EMG-CS, SCL, and HR (Clayton, 2022; Spelt et al., 2022a), which suggests that physiological measures reflect a reactance state, characterized as a state of higher arousal. To conclude, persuasion is effective in changing motivational states and behavioral intentions, both of which are reflected in physiological reactivity.

Future Directions

ELM is a framework widely used in persuasion literature in the attempt to understand which route of information processing is more effective or commonly transit. Our review contributes to the persuasion literature by providing an overview of the principal factors that mediate and moderate which processing route is taken. There is a growing literature on the underlying processes of persuasion (Cacioppo et al., 2018), however, there is a lack of integration presented in systematic reviews about the main factors that influence persuasion efficacy. Also, a promising future direction is to explore how situational states such as perceived stress or state anxiety influence the processing of persuasive health communications.

In the area of health communication and persuasion, research about the effect of reactance has found strategies to mitigate it, such as 'choice-enhancing language' in opposition to 'freedom-threatening language' (Reynolds-Tylus, 2019). However, we suggested further exploration of the effect of situational states as perceived stress in the processing of persuasion and physiological reactions. Stressful situations decrease the processing of information and discrimination between strong and weak arguments (De Miguel et al., 2009), which suggests more heuristic processing as the individual would probably feel high in vulnerability (Das et al., 2003). Perhaps, persuasion in public health communications or medical adherence to treatments could be more efficient in promoting action recommendations if message frames were adapted to situational stress individuals, beyond the disadvantage-frames or fear appeals commonly used.

The findings and future directions outlined in this review hold significant implications for both advancing the understanding of persuasion and enhancing its practical applications. As a systematic review, this work evaluates and synthesizes the existing literature on the roles of emotions and cognition in the persuasion process, while also considering psychological moderating factors. This contributes valuable and up-to-date insights to the persuasion literature.

A key novelty of this review is its focus on physiological responses, which also play a crucial role in persuasion processing. As highlighted by previous researchers (e.g., Cacioppo, 2018; Clayton, 2022; Potter & Bolls, 2012; Spelt et al., 2022b) self-report reliability in measuring the effectiveness of persuasive attempts has been questioned, since it's susceptible to biases considering the retrospective and introspective processing that is required. This is where physiological measures (e.g., ECG, EDA, EMG, and EEG) become especially relevant, as they offer the ability to capture real-time responses during persuasion attempts (compensating the self-reports limitations) in a

non-invasive and accessible manner that also counterbalances the high-cost and limited availability of the neuroimaging techniques (i.e., fMRI).

In terms of practical implications, the findings of this systematic review have broad relevance across fields that rely on persuasion. However, they are particularly pertinent to the health sector, where they can be applied, along with existing patient data (i.e., physiological data), to create more effective and persuasive communications, particularly in health-related contexts.

Limitations

Results in the present review support the idea that emotions affect the processing of persuasive communication through multiple cognitive processes, as stated by the ELM (Petty & Cacioppo, 1986). We highlight the principal moderator factors identified in the relationship between emotions and persuasion, which is relevant in the attempt to tailor any intervention. Despite this, we excluded articles about the neural correlates of persuasion using fMRI from this review, since we focus on psychophysiological measures, so there is a lack of integration with the already known underlying mechanisms of persuasion. The study of the psychophysiological patterns of persuasion is still in its infancy, and this review is just an effort to overview the relationship between persuasion processing, emotions, and physiological reactivity. Future work of this kind is needed to bring together the behavioral, physiological, and neural mechanisms of persuasion.

Conclusions

Overall, the results of the studies included in the present review suggest that several important factors affect persuasion efficacy, such as the route of cognitive elaboration transited. Meanwhile, the extent of elaboration is moderated by various factors such as personal motivation or relevance, individual differences in NFC and NFA, thought confidence, appraisal approach, self-perceived vulnerability and efficacy, demographics, persuasive strategies such as framing and matching, and physiological reactions. The effect of discrete emotions depends on those previously stated factors. However, there are mixed findings regarding their persuasiveness, since some studies still found the emotion of fear effective in engaging individuals in the action recommendation, while more recently others found positive emotions (e.g., hope) more effective for health-related behavior changes. Regarding the psychophysiology of persuasion, the difference in physiological arousal between the processing of persuasive messages versus a rest state and the reactance phenomenon should be further explored. Moreover, for future directions of research, we suggested the study of more situational states such as perceived stress in persuasive health communication. Finally, a more in-depth analysis of gender and age differences in the processing of persuasive communication would be useful for further research studies.

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ORCID iD

Valerie Rodríguez-Hernández https://orcid.org/0000-0001-8335-8056

Note

1. NFC and NFA are two of the individual tendencies most studied in the persuasion literature, however, are not the only ones, as other relevant ones are personality, Behavioral Inhibition System/Behavioral Approach System, and demographics, among others. We chose to study NFC as an individual factor of great relevance to the ELM because it refers directly to the motivation to think and therefore, to message processing. As for NFA, it was added as a counterpart to NFC that considers the affective dimension.

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Author Biographies

Valerie Rodríguez-Hernández Junior doctoral researcher in Neuroscience, exploring the neurocognitive factors in the processing of persuasive health messages, considering individual characteristics and physiological reactivity.

Vanesa Hidalgo Associate Professor of Psychobiology at the Psychology and Sociology Department of the University of Zaragoza, Spain. Her research interests focus on stress response and its impact on cognitive performance.

Alicia Salvador Full Professor of Psychobiology and Head of the Laboratory of Social Cognitive Neuroscience at the University of Valencia. Her research focuses on the biological basis of social behavior, particularly on competitive and other social stress interactions, studying their cognitive and affective effects as well as moderating/mediating factors.