Netspar

The Perceived Convincingness Model

why and under what conditions processing fluency and emotions are valid indicators of a message's perceived convincingness

Hans Hoeken, Karin Fikkers, Anita Eerland, Bregje Holleman, Jos van Berkum, Henk Pander Maat

NETSPAR ACADEMIC SERIES

International Communication Association

OXFORD

The Perceived Convincingness Model: why and under what conditions processing fluency and emotions are valid indicators of a message's perceived convincingness

Hans Hoeken [1,*], **Karin Fikkers** [1], **Anita Eerland** [2], **Bregje Holleman** [1], **Jos van Berkum** [1], **Henk Pander Maat** [1]

[1]Department of Languages, Literature & Communication, Utrecht University, Utrecht, The Netherlands
[2]Department of Communication Sciences, Radboud University, Nijmegen, The Netherlands
*Corresponding author: Hans Hoeken, Utrecht Institute of Linguistics OTS, Utrecht University, Trans 10, NL 3512 JK Utrecht, The Netherlands.
Email: j.a.l.hoeken@uu.nl

Abstract

Persuasive messages aim to influence people's behavior. Arguments in these messages typically refer to the positive consequences of the advocated behavior or the negative consequences of failing to do so. It has been claimed that people automatically generate a judgment about the message's convincingness. We present the Perceived Convincingness Model (PCM) to explain *how* people generate this judgment based upon the fluency with which they process the message and the intensity of the resulting emotions. When these experiences are elicited by the processing of the message's arguments, they can be crude, yet relevant indicators of the extent to which the arguments meet the normative criteria of acceptability, relevance, and sufficiency. Thus, under some conditions, trusting one's feelings may be a rational strategy when deciding to heed an advice or not.

Keywords: argument strength, perceived message effectiveness (PME), processing fluency, informal logic, epistemic vigilance

To act or not to act? Which policies to support, and which to reject? People are confronted with these questions on a daily basis when navigating between choices related to health, relations, work, politics, and the like. Rationally, the answer should depend on the consequences these acts and policies will have for the wellbeing of oneself, one's loved ones, the organizations one works for, and/or the environment one lives in. Communication has served humanity well in this respect. If not for communication, one would have to find out for oneself that sticking a pencil in an electrical outlet is dangerous. However, Sperber et al. (2010, p. 16) point out the downside to these benefits: "People stand to gain immensely from communication with others, but this leaves them open to the risk of being accidentally or intentionally misinformed, which may reduce, cancel, or even reverse these gains." Sperber et al. argue that to reap the benefits of communication while guarding oneself against its drawbacks, people have to be epistemically vigilant.

Mercier and Sperber (2017) identify two cognitive mechanisms of epistemic vigilance. One focuses on the source of information, addressing the question of *whom* to believe. Mercier (2020) reviews factors relevant to this question. Especially when the interests of the sender and receiver align, it makes sense to accept the sender's claims without the need to worry about the arguments. Yet, Mercier and Sperber (2017, p. 189) state that human communication is "definitely not limited to topics of common interest where truthfulness and trust are mutually advantageous to the interlocutors" and "lying and deception are in everybody's repertoire." To benefit from communication with sources we do not (completely) trust, the relevant question is *what* to believe. This is the

second cognitive mechanism of epistemic vigilance identified by Mercier and Sperber (2017). By focusing on the reasons and arguments provided, we can decide whether these warrant accepting the source's claims. Given that we often have no information on a source's knowledge or goals, the question of what to believe question is very important and the central focus of this article.

Mercier and Sperber (2017) argue that people possess a module that is geared toward reasons and arguments, and that immediately and automatically generates an intuition about the convincingness of arguments, regardless of whether these are about the benefits of an electrical toothbrush, the implementation of a comprehensive exam in a bachelor program, or the risks of smoking. They also propose that these rapid convincingness intuitions often approximate the judgments that would result from a more careful, slow evaluation of the arguments. In other words, the module would achieve without conscious effort what everyone who ever took a critical thinking course knows is quite difficult: identifying, evaluating, and weighing arguments, ultimately yielding a perception of a message's convincingness.

These perceptions can have implications for the actual persuasive impact of a message as is evidenced by research on Perceived Message Effectiveness (PME). In health communication, the PME is a widely used measure that results from having participants rate the persuasive potential of a message, typically using items such as "how 'effective,' 'convincing,' or 'persuasive' a health message is" (Yzer et al., 2015, p. 126). Dillard et al. (2007) conducted a meta-analysis on 40 studies in which both PME and the actual message effectiveness were measured; they found a significant correlation of .41 between

the two measures. In a meta-analysis on anti-tobacco messages, Noar et al. (2020) report moderate yet significant correlations between PME and quitting intention ($r = .26$) and actual cessation behavior ($r = .20$). These findings show that perceived convincingness perceptions are indicative of a message's actual impact.

In this article, we present the Perceived Convincingness Model (PCM) to explain how people generate these convincingness intuitions, and under what conditions these intuitions indeed approximate the results a more careful evaluation would have. We hypothesize that people use their subjective experience of fluency while processing a message to estimate if the arguments in a message align with their beliefs and the valence and intensity of emotions to estimate if these arguments are relevant and sufficient. This focus on the message's argumentative content positions the model not only firmly within the field of communication theory; it also enables predicting under what conditions the convincingness intuition is a relatively accurate indicator of the judgment produced by a more careful evaluation using relevant normative criteria. We will first describe what normative criteria should play a role in a careful evaluation of argument strength.

Normative criteria for assessing argument strength

What are the normative criteria one would apply to carefully assess the strength of an argument? Persuasive messages typically aim to influence people's behavior or gain their approval for policy proposals. The supporting arguments therefore focus on the consequences of the propagated behaviors or policies. That is, messages argue that the use of the advertised product will make people more beautiful, adoption of the advocated lifestyle will make them live longer, or implementing this policy will make their world safer. This type of argument is called the argument from consequences, defined by Walton (1996, p. 75) as "a species of practical reasoning where a contemplated policy or course of action is positively supported by citing the good consequences of it. In the negative form, a contemplated action is rejected on the grounds that it will have bad consequences." Both in practice (Schellens & De Jong, 2004) and in research (O'Keefe, 2013), this is the most frequently used type of argument.

Criteria to assess the strength of arguments are offered by the field of Informal Logic (see, for an introduction, Blair, 2015; see, for an application, Hoeken et al., 2020). Informal Logic aims to improve people's critical thinking skills, such as the ability to judge the strength of arguments one encounters in real life policy debates, editorials, and ads. Informal Logic proposes the triad Acceptability, Relevance and Sufficiency as the main criteria for the strength of everyday arguments. We will illustrate these criteria using arguments (from consequences) developed by Petty and Cacioppo (1979) that have been used in numerous persuasion studies.

In these studies, college undergraduates receive a message advocating the implementation of a senior comprehensive exam as a requirement for college graduation. Examples of strong arguments are: Implementing this exam has led to a much larger increase of the undergraduates' GPA (31%) compared to comparable colleges without it (8%); starting salaries are much higher for graduates from colleges with the exam compared to graduates from other colleges. Examples of weak arguments are: Implementing the exam has led to an increase in undergraduates' test anxiety (31%) compared to comparable colleges without it (8%); private companies developing such tests were in favor of implementation, stating "we are not pushing comprehensive exams simply because of the huge amount of money involved. We are genuinely interested in marketing a good product."

Evaluating these arguments using the Informal Logic criteria starts with the acceptability criterion. This criterion refers to accepting the content of the argument as in line with one's world views. For instance, do undergraduates believe that implementation of the exam will lead to an increase of their GPA and a higher starting salary? The second criterion, relevance, is about the adequacy of the link between the argument and the claim. Undergraduates may consider a higher GPA or higher starting salary as relevant for evaluating the desirability of the exam, whereas they may consider the higher profits for companies developing such tests as irrelevant. Finally, the third criterion, sufficiency, refers to the question whether the argument is sufficiently strong to accept the claim. A higher starting salary is a relevant argument, but how much higher should the starting salary be for it to be sufficiently strong to convince people that it is worth the comprehensive exam's extra effort? That is, how desirable is the consequence considered to be?[1]

In summary, carefully considered judgments about the convincingness of a persuasive message should be sensitive to the acceptability, relevance, and sufficiency of the message's arguments. We posit that a module that generates rapid yet valid *intuitions* about message convincingness should therefore be sensitive to the same criteria. In other words, if message A contains arguments a person considers less acceptable, relevant, or sufficient compared to the arguments of message B, the person should intuit that message A is less convincing than message B. But how can the PCM generate this intuition without carefully reflecting upon these criteria?

Perceived convincingness as an intuitive inference generated by a module

Mercier and Sperber (2017) claim that people generate intuitive inferences about a message's convincingness. They position intuitive inferences on a continuum between unconscious and conscious inferences, with these three types differing at the metacognitive level. For *conscious* inferences, we are aware not only of the inference itself, but also of the considerations leading up to it. A judgment of a message's convincingness based on a careful application of the acceptability, relevance, and sufficiency criteria to the message's arguments would be a prime example of a conscious inference. For *unconscious* inferences, people are not even aware that they have gone through an inferential process. Typical examples are inferences in perceptions of visual illusions, where people "see" an object as larger than the other whereas in actuality these objects are exactly the same size (Shepard, 1990), or when people report having seen information that was not in the original message (Miller & Gazzaniga, 1998). *Intuitive* inferences take a middle position with people having "little or no knowledge of reasons for one's intuition, but it is taken for granted that there exist such reasons and that they are good enough to justify the intuitions, at least to some degree" (Mercier & Sperber, 2017, p. 66). So, when people have an intuitive judgment of a message's convincingness, they are

aware that this judgment is based on some inferential process but are not partial to its workings.

Mercier and Sperber (2017) hypothesize that these intuitive inferences are the result of a specialized module. They define modules as "biological modules having a cognitive function" (p. 75). To serve their functions, modules apply procedures on representations to generate an inference. The PCM's cognitive function is to generate an assessment of a message's convincingness. So, the PCM takes a message as its input and provides a convincingness intuition as its output by exploiting certain regularities between the input and the output. To foreshadow our model, we will argue that the PCM employs: (1) the ease with which the message is processed; and (2) the intensity of the emotions elicited as input for generating an inference about the message's convincingness. The model exploits the regularities that: (1) messages that contain information one accepts are typically easier to process than those containing information one rejects; and (2) that relevant and sufficient arguments elicit (strong) emotions.

Mercier and Sperber (2017) argue that modules are an adaptation, a hereditary trait that increases an organism's chance of survival and reproduction. A well-functioning PCM could help a person to distinguish sound from bad advice and thereby increase a person's chances of obtaining shelter, procuring food, and finding a mate. "Well-functioning" implies that the module leads to *normatively* sound intuitions. That is, the intuitions should, to some extent, be in accordance with a judgment that a careful, rational evaluation procedure would come up with. Two points need emphasizing here. First, the idea that the outcome of the module can be similar to the outcome of a rational evaluation procedure does *not* imply that the module itself applies this rational procedure (cf. Chater & Oaksford, 2018 on Bayesian reasoning). Second, we do not claim that the module always provides perfect intuitions. But even a small improvement in making more sound decisions in some cases would be sufficient to provide its owner with an advantage.

Inferring perceived convincingness

The task set for the PCM seems daunting. Both factual information (e.g., Amsterdam is the capital of the Netherlands) and beliefs (e.g., Amsterdam is beautiful) may serve as arguments in a discussion about the location of a firm's headquarters or where to go on vacation. The PCM has to assess whether such arguments are acceptable and relevant to the claim as well as how desirable the consequences are to judge its sufficiency. The latter is especially complex, given that the exact same consequence may be desirable in one case, but undesirable in the other. For instance, "peace and quiet" is a desirable attribute of a hotel room, but not of a club or a bar. How could a single module determine the acceptability, relevance, and sufficiency of such diverse arguments? The answer may lie in the fact that when processing arguments, metacognitive experiences always arise.

Processing fluency and the acceptability criterion

The first normative criterion for argument strength is whether one believes the information expressed in the argument to be true, that is, whether it is in line with one's current beliefs. Mercier (2017, p. 105) refers to this process as plausibility checking: "a mechanism that detects inconsistencies between background beliefs and communicated information, and that tends to reject communicated information when such inconsistencies emerge." In their review, Brashier and Marsh (2020) identify processing fluency as an important determinant of people's truth judgments. Processing fluency is defined as "the subjective experience of ease with which a stimulus is processed" (Reber & Unkelbach, 2010, p. 564). Brashier and Marsh (2020, p. 508) conclude that fluency "shapes perceived truth over long delays, among intelligent people, despite contradictory knowledge, for claims coming from unreliable sources, and in the face of diagnostic advice."

There is indeed considerable empirical evidence for the persuasive impact of processing fluency. In a meta-analysis on the effect of processing fluency on truth judgments, Dechêne et al. (2010) report an effect size of $r = .26$, which is considerably larger than the effect sizes commonly found in persuasion research (O'Keefe & Hoeken, 2021). More recent studies in the field of communication have documented the persuasive effect of processing fluency in various contexts, such as charity advertising (Bae, 2019), risk communication (Bullock et al., 2019), health communication (Bullock & Shulman, 2021; Shulman et al., 2021), website communication (Sohn, 2017), and prosocial behaviors concerning recycling and organ donation (Kim & Jang, 2018).

Schwarz et al. (2021) identify three sources of processing fluency: perceptual factors (such as a speaker's accent or a font's legibility), conceptual factors (such as previous exposure to the same information or the use of jargon), and perceiver factors (such as prior knowledge or motivation). Schwarz et al. conclude that whatever the source of differences in processing fluency is, its impact on the recipient's experiences and judgments is the same. That is, whether higher processing fluency resulted from legible handwriting, repetition of information, or a fit with one's prior knowledge, people believed the message more strongly. The empirical evidence thus shows that people take processing fluency as a cue for the acceptability of the information in the message.

Unkelbach and Rom (2017) introduce the concept of coherence to explain why information one already accepts, is processed more fluently. Cohering concepts are represented as related in the recipient's memory. Sentences containing these cohering concepts are processed more fluently. For instance, most people will process "Amsterdam is the Dutch capital" more fluently than "Brussels is the Dutch capital" because the concepts "Amsterdam" and "Dutch capital" are more strongly related whereas the concepts "Brussels" and "Dutch capital" are not. This type of coherence does not only play a role for factual statements. When processing the sentence "Amsterdam is the perfect holiday destination," the coherence between the concepts of "Amsterdam" and "perfect holiday destination" will depend on whether "Amsterdam" is associated in the receiver's memory to "beautiful art" and "historical city center" or to "prostitution" and "drugs" (as well as how desirable each of these concepts is rated). In their experiments, Unkelbach and Rom (2017) indeed find that if the information in the message coheres with what the receiver already has stored in memory, processing is more fluent compared to *new* information, that is, new concepts or concepts that were yet unrelated in the receiver's memory. Disfluency occurs when the information in the message goes *against* the relations stored in memory.

Interesting in this respect is a series of studies by van Moort et al. (2018, 2020, 2021) in which participants read texts containing information that they knew to be incorrect, for

instance, the statue of liberty did not reach the US. Employing different measures (reading time, eye movements, fMRI), Van Moort et al. report longer processing times for incorrect information. In addition, they manipulated the preceding text to make the incorrect information more or less likely (e.g., by describing the financial problems related to building and transporting the statue of liberty). That is, the incorrect information could be more or less coherent with the preceding message information. In that case, the correct information (e.g., the statue of liberty *did* reach the US) was read more slowly when preceded by information that suggested that it might not make it. These results suggest that processing fluency can serve as an indicator of information that clashes with information stored in memory but also with information within the message.

These results explain why processing fluency can serve as a valid cue for the extent to which a message's arguments meet the acceptability criterion. All else being equal, information that fits with previously held beliefs will be processed more fluently whereas information that goes against those beliefs or against other information in the message will be processed less fluently. This does not imply that processing fluency is an indicator of the *objective* truth of a message's arguments. The relations stored in memory may differ from person to person. Some people may like Amsterdam whereas others hate it; some people may know that Amsterdam is the Dutch capital whereas others may be unsure. Rather, processing fluency is an indicator of the extent to which the statement fits with the receiver's beliefs.

The PCM can thus use processing fluency as an indicator of the extent to which the message's content fits in with what the receiver already believes (the normative criterion of acceptability) and thus provides an indication of the plausibility checking result (Mercier, 2017). Given the ample empirical evidence supporting the relationship between processing fluency and message acceptability, we posit that the PCM exploits processing fluency as a signal of the extent to which the arguments in the message meet the acceptability criterion. This leads to the first proposition:

> **Proposition 1:** Processing fluency is positively related to convincingness intuitions because it can serve as an indicator of the message's arguments' acceptability.

Message elicited emotions and the relevance and sufficiency criteria

Next, we propose that the intensity of the emotions elicited by the processing of arguments can serve as an indicator of the normative criteria of relevance and sufficiency. Processing an argument results in a cognitive representation of the consequence referred to in the argument (e.g., Zwaan & Rapp, 2006). Van Berkum (2018) states that emotions can be evoked by events in real life, such as an aggressive dog evoking fear or the loss of a loved one causing sadness, but also by symbolic representations of such events. Reading about the dangers of smoking may cause fear, watching a commercial about a reunion may cause happiness, listening to a eulogy may cause sadness. Van Berkum argues that we may feel a little sad or a bit happy without being consciously aware of it, and yet even these weak emotions may affect our thoughts and behavior. Finally, he claims that emotions arise because

the appraisal of the (symbolic) event informs us that *our* interests, or the interests of the people we care for, are at stake. We get sadder when *our* paper is rejected than when someone else's is, and we are more scared when *our* job is at stake than that of a stranger.

We posit that the PCM uses the experiencing of emotions as an indicator of arguments meeting the relevance and the sufficiency criteria. Firstly, if representing the consequence referred to in the argument (e.g., a higher starting salary) elicits emotions, this consequence is apparently of relevance to the receiver. If it fails to elicit an emotion, it does not meet the relevance criterion. Secondly, emotions are not simply present or absent, but come in different degrees. When representing a pleasant consequence, a person's emotion may range from "enjoyable" via "thrilled" to "ecstatic"; when representing an undesirable consequence, the emotion may range "irritated," via "annoyed," to "devastated." According to Johnson and Stewart (2005, p. 17), the intensity of the experienced emotions is determined by the extent to which the consequence is related to the person's major interests as well as to the extent to which it serves this interest. For instance, the intensity of an emotion elicited by a financial setback depends on how delicate the monetary situation of this person is as well as on the amount of money that will be lost. There is evidence for the importance of emotions. Rath et al. (2019) show how emotional intensity predicts judgments of the perceived convincingness of 37 anti-tobacco advertisements using a large-scale, nationally weighted sample of young adults.

As in the case of processing fluency, it is important to note that the elicited emotion is an indicator of the extent to which the argument meets the relevance and sufficiency criteria for *this* person. Individuals vary in how they respond to certain consequences. For instance, if hanging out with friends has the consequence of going to a bar, this prospect may elicit strong positive emotions in person A, leave person B cold, and revolt Person C. As a result, the exact same argument may thus be considered strong by A, irrelevant by B, or a counter-argument by C. The PCM thus provides an assessment of the argument's convincingness *as perceived by the receiver*.

Persuasive messages can contain more than a single argument, announced by statements such as, "seven reasons to do X." Each of the individual arguments can elicit an emotion with a certain intensity. How might the PCM handle such multiple-argument messages? Suggestive to this issue is research on the so-called presenter's paradox (Weaver et al., 2016). Weaver et al. compared the persuasiveness of a message containing *only* the strongest arguments in favor of a certain action to the persuasiveness of a message containing these same arguments along with other relevant, yet less strong pro-arguments. The results show that adding these additional arguments yielded a *less* convincing message compared to the one containing only the strongest arguments. These findings suggest that the PCM averages the elicited emotions elicited by the set of arguments.

In the research on the presenter's paradox, all arguments point to the undesirable consequences of smoking or the desirable consequences of engaging in fitness. But most actions have both desirable and undesirable consequences. These different consequences can be considered pro and counterarguments. For an assessment of the message's convincingness as a whole, they need to be weighed. For instance, when making up their mind about the implementation of a

comprehensive exam, students have to weigh the extra effort such an exam will bring against a higher starting salary. This weighing is complicated as these consequences are on different dimensions. How much higher does the starting salary need to be to compensate the additional effort caused by the exam?

In normative models of the decision process, the multi-attribute utility theory has been proposed as a solution (Baron, 2000). When choosing between buying a new laptop or sticking to the old one, one has to weigh the pleasure of working more comfortably against the financial costs. In the multi-attribute utility theory, the extent to which a certain consequence brings about a certain goal or is in accordance with a certain value, is expressed in terms of its "utility." If both comfort and costs are expressed in the same "utility" metric, one can compute whether the additional comfort is worth the extra money. Utility thus serves as a common currency between the different consequences. Several researchers have pointed out that emotional valence can serve as such a common currency (see, e.g., Cabanac, 2002), that is "evaluated much like utility" (Lerner et al., 2015, p. 815), thus enabling people "to compare apples to oranges" (Peters et al., 2006, p. s149). Pfister and Böhm (2008, p. 13) call this the informative function of emotions: "Emotional states such as joy or distress inform about the degree of (un)pleasantness of actions and consequences. They allow to map a diversity of experiences on a one-dimensional scale of pleasure and pain."[2]

To illustrate this process, consider a study in which the comprehensive exam topic is used. Participants will likely experience a negative emotion when they learn that they will have to study for and pass that exam to graduate. When subsequently receiving the argument that they are likely to earn a higher starting salary, a positive emotion will arise. The perceived convincingness of this message will depend on the extent to which the positive emotion resulting from the prospect of a higher salary outweighs the negative emotion of having to pass the exam. If these participants were to be exposed to the weak argument that they will experience more test anxiety, the negative emotion will be strengthened, and they will perceive the message as less convincing.

The importance of emotions elicited by processing messages that subsequently influence decision-making has received much attention in the field of embodied cognition (see, e.g., Winkielman et al., 2015). Hardy (2021) reviews this research and its relevance to communication theory. In discussing Damasio's (1994) somatic markers, Hardy states: "In response to these mentally simulated future outcomes, our bodies instantly produce feelings (the somatic markers) before any cognitive reasoning is applied or cost/benefit analysis calculated. These bodily feelings produce associated emotions that are influential in decision making" (Hardy, 2021, p. 36). He then illustrates this idea by showing how these emotional responses play a role in responding to fear appeals.

There is empirical evidence for the role of emotions in evaluating alternatives. Rasch et al. (2015) used facial Electromyography (EMG) measures to study the role of affect when people had to choose between various alternatives. They report that facial muscle activity, which is considered a valid indicator of affect, reflected the relative utility of the different alternatives. Suri et al. (2013) conducted four studies revealing the predictive power of emotional valence and arousal on people's preferences and choices. Young et al.

(2019) show that the immediately elicited emotion by a choice alternative influences its attractiveness whereas Huber et al. (2011) document the impact of these immediate emotions on people's intention to provide financial support for humanitarian aid.

In addition, there is ample evidence for the impact of emotions on the evaluation of messages. For advertising, several meta-analyses have shown that advertisements that elicit positive emotions yield more favorable attitudes toward the ad as well as more positive attitudes toward the brand whereas advertisements eliciting negative emotions have the opposite effect (see, e.g., Brown et al., 1998; Eisend, 2011; Pham et al., 2013). For health communication, emotional responses have been shown repeatedly to influence people's evaluation of a persuasive message's effectiveness (Paek et al., 2011; Yzer et al., 2011). Popova and Li (2022) show that the emotional responses influence convincingness judgments without needing conscious reflection by the audience.

In sum, the PCM predicts that when processing a persuasive message, people generate mental representations of the depicted consequences of the propagated behavior. If these representations do not elicit a (strong enough) emotion, the person's interests appear not to be at stake and the message's arguments fail to meet the relevance criterion. This would result in a lower intuited convincingness. The more impact these consequences have on the person's goals, and the more important these goals are to the person, the stronger the emotions become, and the more sufficient the argument is considered to be. The valence of the emotions can serve as a shared standard to weigh the importance of consequences that have their impact on different dimensions. The overall convincingness intuition is then determined by the valence and intensity of the resulting emotion.

> **Proposition 2:** The valence and intensity of the experienced emotion after processing a persuasive message are positively related to the convincingness intuition because they can serve as an indicator of the message's arguments' relevance and sufficiency.

When should convincingness intuitions be trusted?

The PCM specifies what mechanisms can produce convincingness intuitions by exploiting meta-cognitive experiences, notably processing fluency and emotions. As such, it resembles models such as the Feeling-as-Information theory (Schwarz, 2011; Schwarz & Clore, 2007), and the affect heuristic (Slovic et al., 2005). However, what it sets apart from these models, and puts it firmly within the field of communication theory is: (1) that it shows *how* these meta-cognitive experiences are related to the relevant normative criteria for argument strength (acceptable, relevant, sufficient); and (2) thereby explains *why* convincingness intuitions can approximate a convincingness judgment a more careful evaluation would produce.

The PCM predicts that a message containing arguments that meet the normative criteria of acceptability, relevance, and sufficiency should elicit a more positive convincingness intuition compared to a message containing arguments that meet these criteria to a lesser extent. That is, if message A contains only acceptable information whereas message B contains

a statement the recipient rejects, message A should be intuited to be more convincing. This effect is predicted to be mediated by a difference in processing fluency. Likewise, if message A depicts consequences that are more desirable to the recipient's eye than message B and thus succeeds in eliciting stronger emotions, message A should be intuited to be more convincing.

The fact that its intuitions *can* approximate the judgment of a more careful evaluation does not imply that they always *do*. If these intuitions were flawless indicators of the message's convincingness, why would anyone ever engage in a time-consuming, effortful evaluation of the arguments? The fallibility of these intuitions results from the fact that the PCM is sensitive to (differences in) processing fluency or emotions *regardless of their origin*. For processing fluency to be a valid indicator of acceptability, it should be disrupted by an argument that is rejected by the recipient. But as discussed before, processing fluency, and the subsequent truth effect, is also sensitive to perceptual factors such as legibility or the simple repetition of information (Schwarz et al., 2021).

Interesting for the role of emotion in generating convincingness intuitions is the distinction made by Loewenstein and Lerner (2002) between *integral* affect, that is, affect resulting from the consideration of the judgmental target, and *incidental* affect, that is, affect elicited by factors other than the judgmental target, examples being mood, priming, or affective conditioning. Research has shown that incidental affect is as effective as integral affect in influencing people's preferences and decisions (Västfjäll et al., 2016). For the PCM to generate valid convincingness intuitions, emotions should be elicited by the consequences depicted in the arguments, yet it is as sensitive to incidental emotions as well.

From this insensitivity to the origins of processing fluency and emotions follow several predictions. If message A contains the exact same arguments as message B, but is written in an easier to comprehend way, the PCM will infer message A to be more convincing than message B because of its higher processing fluency. Emotions elicited by a beautiful picture unrelated to the message content can influence convincingness intuitions as well as the depictions of the consequences in the arguments. And the PCM is sensitive only to the argument from consequences type, but not to other types such as the argument from analogy or the argument from example. These arguments need to meet other criteria to be considered strong. In the case of the argument from analogy, the similarity between the cases compared is at stake; for the argument from example, the number and representativeness of the examples is important. Research has shown that people are sensitive to these criteria (see, e.g., Hoeken & Hustinx, 2009; Hoeken et al., 2014). However, the PCM is predicted to be insensitive to failures to meet these criteria as long as these differences do not come with differences in processing fluency and elicited emotions. If "thinking is for doing," and the rational choice between actions should depend on the consequences of these actions, this focus on the argument from consequences is logical.

The PCM and the elaboration likelihood model

Dual-process models of the persuasion process, such as the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986), argue that people can accept the claim of a message either after a careful evaluation of the supporting arguments (the central route to persuasion) or as a result of positive feelings elicited by peripheral cues (the peripheral route to persuasion). The PCM is clearly situated on the peripheral route. As such, it addresses the call by Briñol et al. (2012) who argue that it is important to specify through which mechanisms meta-cognitive experiences attain their impact as the size and the stability of this effect depends on it. The PCM proposes processing fluency and emotional experience as specific mechanisms that may influence a message's persuasiveness especially if people do not engage in argument scrutiny.

But the PCM does more than that. The ELM predicts that the impact of argument strength will be more prominent for centrally processing people compared to peripherally processing ones because only the former will note the strength in strong arguments (or the weakness in weak arguments). Carpenter (2015) conducted a meta-analysis on the impact of argument strength manipulations on people's attitudes. He concludes that, in line with the ELM's predictions, the difference in persuasive impact of messages with strong versus weak arguments is larger for centrally processing participants compared to the peripherally processing participants. Yet, even for the latter group, a small but significant effect of argument strength was found.

When comparing centrally and peripherally processing participants after reading the strong arguments message, the attitudes of the former are more positive than the latter. When doing the same for the weak arguments message, an interesting effect occurs. If the arguments provide only weak support for the message's claim, one would expect the claim to be rejected. Yet the findings show that the attitude of the centrally processing participants is even lower than that of the peripherally processing participants. This suggests that carefully evaluating the weak arguments has a sort of boomerang effect with centrally processing participants moving away from the advocated position. The PCM can explain this effect.

A popular way to distinguish centrally from peripherally processing participants is to manipulate outcome-relevant involvement. In the studies using the implementation of the comprehensive exam message, half of the (undergraduate) participants were told that they would have to take the exam themselves to graduate, the other half were told that the exam would be implemented at a distant university in 10 years.

From the PCM point of view, manipulating involvement in this way has direct consequences for the argument's strength. Consider the argument that graduates who take this exam will get a higher starting salary. For the participants in the high involvement condition, this representation entails that *they themselves* will get a higher starting salary; for the ones in the low involvement condition, this representation entails that other students will get a higher starting salary. The PCM predicts that when representing this consequence, participants in the high involvement condition will experience stronger positive emotions than those in the low involvement condition. Likewise, the weak argument that such an exam will lead to an increase in test anxiety, will evoke a more negative response for the participants in the high involvement condition as they will experience this anxiety themselves whereas the negative response will be weaker for those in the low involvement condition.

The PCM thus explains why the weak arguments message leads to a more negative attitude for the centrally processing participants compared to the peripherally processing ones and why there might even be a small effect of argument strength for peripherally processing participants. In addition,

whereas the ELM presupposes this effect only to occur after people have had time to process the arguments carefully, the PCM predicts that immediately after processing the message, people in the high involvement condition already infer the strong arguments message to be more convincing than the weak arguments messaging.

Conclusion

Every day, people face many messages that aim to change their opinions and behaviors. And almost automatically and effortlessly, people have an intuition about how convincing these messages are. Because people often refrain from a more careful, slow evaluation of the extent to which the message arguments support its claims, such rapid "convincingness intuitions" typically play a decisive role in whether people accept a message. Interestingly, Mercier and Sperber (2017) have proposed that these rapid convincingness intuitions often approximate the judgments that would result from a more careful, slow evaluation of the message. The PCM specifies why that may be the case. Even if these intuitions are only a slight improvement in assessing a message's true convincingness, this improvement may have far-reaching consequences given the large number of cases in which these intuitions decide whether we accept the message or not.

Understanding how these judgments come about, when they are a relatively valid, and when they are not, is therefore highly important. Such insights would open opportunities for training people's critical thinking skills. Usually, these courses start at the deep end: How to identify, evaluate, and weigh arguments. The PCM provides an angle to start on the shallow end: What is your intuition about this message? How easy or hard did you find the message to process? And was that because of the presence (or absence) of implausible information of because of a different factor? Do you feel anything about the message? And if so, where does this feeling come from? As such, it may help people to decide when to trust their intuition about a message's convincingness and when not to. Such insights may help them to improve their epistemic vigilance and to optimally profit from communication.

Author note

Funding

Notes

1 Considering the last criterium mentioned here (sufficiency), there is a widely held consensus within argumentation theory (see, e.g., Schellens & De Jong, 2004; Walton, 1996) and persuasion theory (see, e.g., Petty & Wegener, 1991) on the two most important criteria to assess the sufficiency of an argument from consequences. First, the consequence referred to has to be desirable (in case of an argument in favor of the behavior) or undesirable (in case of an argument against the behavior). Second, the consequence has to be likely to result from performing the behavior. The more desirable and the more likely the consequence is, the stronger the argument *in favor* of the behavior is; the more undesirable and the more likely the consequence is, the stronger the argument *against* a certain action is. O'Keefe (2013, p. 118) reports ample evidence for the claim that arguments referring to more desirable outcomes are more persuasive than arguments referring to less desirable ones, to the extent that he considers it "perhaps the single best empirically supported generalization about persuasion." Although people prove to be sensitive to the desirability criterion, they are *not* sensitive to differences in the *likelihood* of a consequence's occurrence. Loewenstein et al. (2001) observe that people consider a consequence either to occur or not, ignoring more subtle probability levels such as somewhat likely, likely or highly likely (see also, Rottenstreich & Hsee, 2001). This effect is called "probability neglect" (Sunstein, 2003). Therefore, we take this evidence to suggest that the PCM should only be sensitive to the desirability dimension and not so much to the likelihood dimension, within the context of assessing "Sufficiency."

2 The various consequences may differ with respect to the discrete emotions they elicit. One consequence may elicit fear, another sadness, whereas still another evokes joy. In our model, these different emotions are hypothesized to be combined into a single point on a valence scale. Shuman et al. (2013) describe how these "qualitatively different types of evaluations, potentially resulting in mixed feelings" can be translated into a one-dimensional macro-valence score that can serve as an integrative "common currency" to compare alternatives for choices.

References

Bae, M. (2019). Influences of identified victim images on processing fluency. *Journal of Nonprofit & Public Sector Marketing*, *31*(3), 249–273. https://doi.org/10.1080/10495142.2018.1526740

Baron, J. (2000). *Thinking and deciding* (3rd ed.). Cambridge University Press.

Blair, J. A. (2015). What is informal logic? In F. H. van Eemeren & B. Garssen (Eds.), *Reflections on theoretical issues in argumentation theory* (pp. 27–42). Springer.

Brashier, N. M., & Marsh, E. J. (2020). Judging truth. *Annual Review of Psychology*, *71*, 499–515. https://doi.org/10.1146/annurev-psych-010419-050807

Briñol, P., Tormala, Z. L., & Petty, R. E. (2012). Ease and persuasion. Multiple processes, meanings, and effects. In C. Unkelbach, & R. Greifeneder (Eds.), *The experience of thinking: How the fluency of mental processes influences cognition and behaviour* (pp. 101–118). Taylor & Francis Group.

Brown, S., Homer, P., & Inman, J. (1998). A meta-analysis of relationships between ad-evoked feelings and advertising responses. *Journal of Marketing Research*, *35*(1), 114–126. https://doi.org/10.1177/002224379803500111

Bullock, O. M., Colón Amill, D., Shulman, H. C., & Dixon, G. N. (2019). Jargon as a barrier to effective science communication: Evidence from metacognition. *Public Understanding of Science (Bristol, England)*, *28*(7), 845–853. https://doi.org/10.1177%2F0963662519865687

Bullock, O. M., & Shulman, H. C. (2021). Utilizing framing theory to design more effective health messages about tanning behavior among

college women. *Communication Studies*, 72(3), 319–332. https://doi.org/10.1080/10510974.2021.1899007

Cabanac, M. (2002). What is emotion? *Behavioural Processes*, 60(2), 69–83. https://doi.org/10.1016/S0376-6357(02)00078-5

Carpenter, C. J. (2015). A meta-analysis of the ELM's argument quality × processing type predictions. *Human Communication Research*, 41(4), 501–534. https://doi.org/10.1111/hcre.12054

Chater, N., & Oaksford, M. (2018). The enigma is not entirely dispelled: A review of Mercier and Sperber's The Enigma of Reason. *Mind & Language*, 33(5), 525–532. https://doi.org/10.1111/mila.12181

Damasio, A. R. (1994). *Descartes' error: Emotion, reason and the human brain*. Putnam.

Dechêne, A., Stahl, C., Hansen, J., & Wänke, M. (2010). The truth about the truth: A meta-analytic review of the truth effect. *Personality and Social Psychology Review: An Official Journal of the Society for Personality and Social Psychology, Inc*, 14(2), 238–257. https://doi.org/10.1177/1088868309352251

Dillard, J. P., Weber, K. M., & Vail, R. G. (2007). The relationship between the perceived and actual effectiveness of persuasive messages: A meta-analysis with implications for formative campaign research. *Journal of Communication*, 57(4), 613–631. https://doi.org/10.1111/j.1460-2466.2007.00360.x

Eisend, M. (2011). How humor in advertising works: A meta-analytic test of alternative models. *Marketing Letters*, 22(2), 115–132. https://doi.org/10.1007/s11002-010-9116-z

Hardy, B. W. (2021). Embodied cognition in communication science. *Communication Theory*, 31(4), 633–653. https://doi.org/10.1093/ct/qtaa003

Hoeken, H., Hornikx, J., & Linders, Y. (2020). The importance and use of normative criteria to manipulate argument quality. *Journal of Advertising*, 49(2), 195–201. https://doi.org/10.1080/00913367.2019.1663317

Hoeken, H., & Hustinx, L. (2009). When is statistical evidence superior to anecdotal evidence? The role of argument type. *Human Communication Research*, 35(4), 491–510. https://doi.org/10.1111/j.1468-2958.2009.01360.x

Hoeken, H., Šorm, E., & Schellens, P. J. (2014). Arguing about beliefs: Lay people's criteria to distinguish strong arguments from weak ones. *Thinking & Reasoning*, 20(1), 77–98. https://doi.org/10.1080/13546783.2013.807303

Huber, M., Van Boven, L., McGraw, A. P., & Johnson-Graham, L. (2011). Whom to help? Immediacy bias in judgments and decisions about humanitarian aid. *Organizational Behavior and Human Decision Processes*, 115(2), 283–293. https://doi.org/10.1016/j.obhdp.2011.03.003

Johnson, A. R., & Stewart, D. W. (2005). A reappraisal of the role of emotion in consumer behavior: Traditional and contemporary approaches. In N. K. Malhotra (Ed.), *Review of marketing research* (pp. 3–33). Routledge.

Kim, H. J., & Jang, J. M. (2018). The easier the better: How processing fluency influences self-efficacy and behavioral intention in pro-social campaign advertising. *Sustainability*, 10(12), 4777. https://doi.org/10.3390/su10124777

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual Review of Psychology*, 66, 799–823. https://doi.org/10.1146/annurev-psych-010213-115043

Loewenstein, G., & Lerner, J. S. (2002). The role of affect in decision making. In R. J. Davidson, H. H. Goldsmith, & K. R. Scherer (Eds.), *The handbook of affective science* (pp. 619–642): Oxford University Press.

Loewenstein, G. F., Weber, E. U., Hsee, C. K., & Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127(2), 267–286. https://doi.org/10.1037/0033-2909.127.2.267

Mercier, H. (2017). How gullible are we? A review of the evidence from psychology and social science. *Review of General Psychology*, 21(2), 103–122. http://dx.doi.org/10.1037/gpr0000111

Mercier, H. (2020). *Not born yesterday*. Princeton University Press.

Mercier, H., & Sperber, D. (2017). *The enigma of reason*. Harvard University Press.

Miller, M. B., & Gazzaniga, M. S. (1998). Creating false memories for visual scenes. *Neuropsychologia*, 36(6), 513–520. https://doi.org/10.1016/S0028-3932(97)00148-6

Noar, S. M., Barker, J., Bell, T., & Yzer, M. (2020). Does perceived message effectiveness predict the actual effectiveness of tobacco education messages? A systematic review and meta-analysis. *Health Communication*, 35(2), 148–157. https://doi.org/10.1080/10410236.2018.1547675

O'Keefe, D. J. (2013). The relative persuasiveness of different forms of arguments from consequences: A review and integration. In C. Salmon (Ed.), *Communication yearbook*. (Vol. 36, pp. 109–135). Routledge.

O'Keefe, D. J., & Hoeken, H. (2021). Message design choices don't make much difference to persuasiveness and can't be counted on—Not even when moderating conditions are specified. *Frontiers in Psychology*, 12, 664160. https://doi.org/10.3389/fpsyg.2021.664160

Paek, H.-J., Hove, T., Kim, M., & Jeong, H. J. (2011). Mechanisms of child abuse public service announcement effectiveness: Roles of emotional response and perceived effectiveness. *Health Communication*, 26(6), 534–545. http://dx.doi.org/10.1080/10410236.2011.558334

Peters, E., Lipkus, I., & Diefenbach, M. A. (2006). The functions of affect in health communications and in the construction of health preferences. *Journal of Communication*, 56(suppl_1), S140–S162. https://doi.org/10.1111/j.1460-2466.2006.00287.x

Petty, R. E., & Cacioppo, J. T. (1979). Issue involvement can increase or decrease persuasion by enhancing message-relevant cognitive responses. *Journal of Personality and Social Psychology*, 37(10), 1915–1926. https://doi.org/10.1037/0022-3514.37.10.1915

Petty, R. E., & Cacioppo, J. T. (1986). *Communication and persuasion: Central and peripheral routes to attitude change*. Springer.

Petty, R. E., & Wegener, D. T. (1991). Thought systems, argument quality, and persuasion. In R. S. Wyer & T. K. Srull (Eds.), *The content, structure, and operation of thought systems* (pp. 147–162). Erlbaum.

Pfister, H. R., & Böhm, G. (2008). The multiplicity of emotions: A framework of emotional functions in decision making. *Judgment and Decision Making*, 3(1), 5–17. http://journal.sjdm.org/bb1/bb1.html

Pham, M. T., Geuens, M., & De Pelsmacker, P. (2013). The influence of ad-evoked feelings on brand evaluations: Empirical generalizations from consumer responses to more than 1000 TV commercials. *International Journal of Research in Marketing*, 30(4), 383–394. http://dx.doi.org/10.1016/j.ijresmar.2013.04.004

Popova, L., & Li, Y. (2022). Perceived message effectiveness: Do people need to think about message effectiveness to report the message as effective? *Health Education & Behavior*, 109019812110684. https://doi.org/10.1177/10901981211068412

Rasch, C., Louviere, J. J., & Teichert, T. (2015). Using facial EMG and eye tracking to study integral affect in discrete choice experiments. *Journal of Choice Modelling*, 14, 32–47. https://doi.org/10.1016/j.jocm.2015.04.001

Rath, J. M., Green, M. P., Vallone, D. M., Briggs, J., Palmerini, M., Geraci, J., Pitzer, L., & Hair, E. C. (2019). The role of emotions and perceived ad effectiveness: Evidence from the truth finishit campaign. *American Journal of Health Promotion : AJHP*, 33(8), 1152–1158. https://doi10.1177/0890117119864919

Reber, R., & Unkelbach, C. (2010). The epistemic status of processing fluency as source for judgments of truth. *Review of Philosophy and Psychology*, 1(4), 563–581. https://doi10.1007/s13164-010-0039-7

Rottenstreich, Y., & Hsee, C. K. (2001). Money, kisses, and electric shocks: On the affective psychology of risk. *Psychological Science*, 12(3), 185–190. https://doi.org/10.1111/1467-9280.00334

Schellens, P. J., & De Jong, M. (2004). Argumentation schemes in persuasive brochures. *Argumentation*, 18(3), 295–323. https://doi:10.1023/B:ARGU.0000046707.68172.35

Schwarz, N. (2011). Feelings-as-information theory. In P. van Lange, A. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology* (Vol. 1, pp. 289–308). Sage.

Schwarz, N., & Clore, G. L. (2007). Feelings and phenomenal experiences. In A. Kruglanski & E. T. Higgins (Eds.), *Social psychology. Handbook of basic principles* (2nd ed., pp. 385–407). Guilford.

Schwarz, N., Jalbert, M., Noah, T., & Zhang, L. (2021). Metacognitive experiences as information: Processing fluency in consumer judgment and decision making. *Consumer Psychology Review*, 4(1), 4–25. https://doi.org/10.1002/arcp.1067

Shepard, R. N. (1990). *Mind sights: Original visual illusions, ambiguities, and other anomalies, with a commentary on the play of mind in perception and art*. WH Freeman/Times Books/Henry Holt & Co.

Shulman, H. C., Bullock, O. M., & Riggs, E. E. (2021). The interplay of jargon, motivation, and fatigue while processing COVID-19 crisis communication over time. *Journal of Language and Social Psychology*, 40(5-6), 546–573. https://doi.org/10.1177/0261927X211043100

Shuman, V., Sander, D., & Scherer, K. R. (2013). Levels of valence. *Frontiers in Psychology*, 4, 261. https://doi.org/10.3389/fpsyg.2013.00261

Slovic, P., Peters, E., Finucane, M. L., & MacGregor, D. G. (2005). Affect, risk, and decision making. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association*, 24(4S), S35–S40. https://doi.org/10.1037/0278-6133.24.4.S35

Sohn, S. (2017). Consumer processing of mobile online stores: Sources and effects of processing fluency. *Journal of Retailing and Consumer Services*, 36, 137–147. http://dx.doi.org/10.1016/j.jretconser.2017.01.008

Sperber, D., Clément, F., Heintz, C., Mascaro, O., Mercier, H., Origgi, G., & Wilson, D. (2010). Epistemic vigilance. *Mind & Language*, 25(4), 359–393. https://doi.org/10.1111/j.1468-0017.2010.01394.x

Sunstein, C. R. (2003). Terrorism and probability neglect. *Journal of Risk and Uncertainty*, 26(2-3), 121–136. https://doi.org/10.1023/A:1024111006336

Suri, G., Sheppes, G., & Gross, J. J. (2013). Predicting affective choice. *Journal of Experimental Psychology. General*, 142(3), 627–632. http://dx.doi.org/10.1037/a0029900

Unkelbach, C., & Rom, S. C. (2017). A referential theory of the repetition-induced truth effect. *Cognition*, 160, 110–126. https://doi.org/10.1016/j.cognition.2016.12.016

Van Berkum, J. (2018). Language comprehension, emotion, and sociality - Aren't we missing something? In S. Rueschemeyer & G. Gaskell (Eds.), *The Oxford handbook of psycholinguistics* (pp. 644–669). Oxford University Press.

van Moort, M. L., Jolles, D. D., Koornneef, A., & van den Broek, P. (2020). What you read versus what you know: Neural correlates of accessing context information and background knowledge in constructing a mental representation during reading. *Journal of Experimental Psychology. General*, 149(11), 2084–2101. https://doi.org/10.1037/xge0000764

van Moort, M. L., Koornneef, A., & van den Broek, P. W. (2018). Validation: Knowledge-and text-based monitoring during reading. *Discourse Processes*, 55(5-6), 480–496. https://doi.org/10.1080/0163853X.2018.1426319

van Moort, M. L., Koornneef, A., & van den Broek, P. W. (2021). Differentiating text-based and knowledge-based validation processes during reading: Evidence from eye movements. *Discourse Processes*, 58(1), 22–41. https://doi.org/10.1080/0163853X.2020.1727683

Västfjäll, D., Slovic, P., Burns, W. J., Erlandsson, A., Koppel, L., Asutay, E., & Tinghög, G. (2016). The arithmetic of emotion: Integration of incidental and integral affect in judgments and decisions. *Frontiers in Psychology*, 7, 325. https://doi.org/10.3389/fpsyg.2016.00325

Walton, D. (1996). *Argumentation schemes for presumptive reasoning*. Lawrence Erlbaum.

Weaver, K., Hock, S. J., & Garcia, S. M. (2016). Top 10" reasons: When adding persuasive arguments reduces persuasion. *Marketing Letters*, 27(1), 27–38. https://doi.org/10.1007/s11002-014-9286-1

Winkielman, P., Niedenthal, P., Wielgosz, J., Eelen, J., & Kavanagh, L. C. (2015). Embodiment of cognition and emotion. In M. Mikulincer, P. R. Shaver, E. Borgida, & J. A. Bargh (Eds.), *APA handbook of personality and social psychology, Vol. 1. Attitudes and social cognition* (pp. 151–175). American Psychological Association. https://doi.org/10.1037/14341-004

Young, N. A., Shuster, M. M., & Mikels, J. A. (2019). The sure thing: The role of integral affect in risky choice framing. *Emotion (Washington, D.C.)*, 19(6), 1035–1043. https://psycnet.apa.org/doi/10.1037/emo0000505

Yzer, M., LoRusso, S., & Nagler, R. H. (2015). On the conceptual ambiguity surrounding perceived message effectiveness. *Health Communication*, 30(2), 125–134. https://doi.org/10.1080/10410236.2014.974131

Yzer, M. C., Vohs, K. D., Luciana, M., Cuthbert, B. N., & MacDonald, A. W. (2011). Affective antecedents of the perceived effectiveness of antidrug advertisements: An analysis of adolescents' momentary and retrospective evaluations. *Prevention Science: The Official Journal of the Society for Prevention Research*, 12(3), 278–288. https://doi.org/10.1007/s11121-011-0212-y

Zwaan, R. A., & Rapp, D. N. (2006). Discourse comprehension. In M. J. Traxler & M. A. Gernsbacher (Eds), *Handbook of psycholinguistics* (2nd Ed., pp. 725–764). Academic Press.