



# Blends of emotions and innovation (Non)adoption: A focus on green energy innovations

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## ABSTRACT

Following calls for more research into the subjective experience of actors in sustainability transitions, this study examines the blends of emotions that consumers experience in the different stages of the innovation adoption process and how emotions inside a blend are interrelated to help or hinder innovation adoption. Focusing on energy-related innovations, an exploratory, interpretive study of 23 individuals in different stages of the adoption process unveils blends of emotions that underpin their (dis)inclination to adopt green energy innovations. Finally, the study shows that emotions may combine to ignite innovation adoption, halt it, paralyze consumers, or prompt a search for other/more energy solutions. The findings call for other methodological approaches to study the role of emotions in the green innovation adoption and suggest applications for transition scholars and practitioners.

## 1. Introduction

In recent years, the socio-technical sustainability transitions agenda has called for more research at the micro level (Köhler et al., 2019) and, specifically, about the psychological processes that may explain the mobilization of individual actors in sustainability transitions (Upham et al., 2020). Understanding the subjective experience of individual actors is fundamental, as this inner perspective is foundational to understanding why and how change happens (Upham and Gathen, 2021). Given the centrality of innovations as enablers of socio-technical transitions (Martiskainen and Sovacool, 2021), zooming in on actors' situated experiences with these innovations and how these experiences influence their actions may provide valuable insights to enable the transition to sustainable, low carbon futures (De Vries et al., 2021; Upham and Gathen, 2021).

This stream of research has paid growing attention to the role of emotions in sustainable transitions. Whereas past studies had eschewed emotions in favor of cognitive-dominant approaches (Martiskainen and Sovacool, 2021; Steinert and Roeser, 2020), recent studies have clarified the role of emotions in the (non)adoption of sustainable innovations (for reviews, see Brosch and Steg, 2021; Martiskainen and Sovacool, 2021) or innovations more broadly (Valor et al., 2022b). Emotions modulate agents' decision-making because they have informational and motivational influence: they affect individuals' meaning-making processes (Lerner et al., 2015; Pham, 2007) and provide the motivational force to act (Bagozzi et al., 1999; Frijda, 2007). Beyond the intrapersonal influence, emotions are relevant at the collective level: emotions attach individuals to existing objects and institutional orders—which may also

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explain inertia and resistance to innovations (Castro et al., 2020)—but they also enable actors to change existing institutional arrangements and modulate them accordingly to fantasized futures (Voronov and Vince, 2012). Emotions are also involved in diffusion processes (Valor, 2020): because emotions are communicated to others and become contagious (Brosch and Steg, 2021; Martiskainen and Sovacool, 2021), they act as a structuring force of markets (Gopaldas, 2014). Moreover, as emotions are shared by different market actors, they stabilize as structures of feeling, contributing to the institutionalization of a given innovation or social practice (Gopaldas, 2014; Valor et al., 2022a). This work's underlying tenet is that understanding emotions at the micro level may enable a better understanding of the possible transformation paths at the macro level (Köhler et al., 2019; Papachristos, 2018), as emotions serve as a concept able to bridge the individual and the collective, the agency and structure (Upham and Gathen, 2021) and, for this reason, can enrich our knowledge of transition pathways (Martiskainen and Sovacool, 2021).

Two aspects have received less attention in this growing scholarship. First, as shown by recent reviews (Brosch and Steg, 2021; Martiskainen and Sovacool, 2021; Valor et al., 2022b), consumers experience a wide *palette* of positive and negative emotions in the process of innovation adoption. The experience of blends of emotions or combinations of different emotions is habitual when individuals are trying to make sense of complex events or contexts (Fong, 2006; Rothman and Melwani, 2017), such as sustainable innovations. Past works have examined the individual influence that these emotions have on innovation (non)adoption (e.g., Castro et al., 2020; Rezvani et al., 2018), or have studied aggregated emotions, usually according to their valence, examining the influence of these aggregated emotions on innovation adoption (e.g., Moons and De Pelsmacker, 2015; Onwezen et al., 2019; Schikofsky et al., 2020). This approach not only implies treating emotions as an overarching reaction to innovations that overlooks the influence of the specific content of emotions (Valor et al., 2022b), but it also prevents exploring how emotions are interrelated and lead to either facilitating or hindering adoption. However, a close reading of past studies suggests that there could be disparate relationships between emotions inside a blend and that these relationships modulate the overall action tendency of that blend. For instance, Martiskainen and Sovacool (2021) proposed a blend of four emotions (anger, desire, joy, and pride) that mobilizes consumer adoption of electrical vehicles (EVs). This blend facilitates adoption because the discrete emotions forming the blend have synergic or reinforcing relationships with one another. In contrast, other research identifies blends with a paralyzing action tendency. To illustrate, Sirieix et al.'s study of the adoption of “doggy bags” (2017) showed that consumers simultaneously experienced shame (for asking for the doggy bag) and guilt (for not asking for it). It is plausible that, because these two emotions have a counterbalancing relationship with one another, the combination of shame and guilt resulted in consumer paralysis; this paralysis, in turn, limited the adoption of this social innovation. Thus, explaining the structural relationships that emotions have with one another in a blend, and with the overall action tendency of facilitating (hindering) adoption, will extend our knowledge of how emotions modulate innovation (non)adoption. Or more formally, *RQ1a. What blends of emotions do consumers experience?* and *RQ1b. How do emotions in that blend relate to one another to either facilitate or hinder innovation adoption?*

Second, innovation adoption follows a series of stages (Sanguinetti et al., 2018), ranging from awareness of the innovation, consideration or contemplation of adoption, learning, and habituation or continued stage (Arts et al., 2011; Zenobia and Weber, 2013). Past studies have examined how emotions influence these different stages (Martiskainen and Sovacool, 2021; Valor et al., 2022b) and how emotions may change over time (Bettiga and Lamberti, 2018; Wood and Moreau, 2006). However, we do not know whether the same emotion may influence (non)adoption differently depending on the stage, even though there is evidence to suggest that this is the case. For instance, fear of supply cuts leads consumers to gain awareness of energy self-production technologies, but fear of the potential building damage that solar panels may produce leads consumers to reject this technology (Scheller et al., 2021). This study suggests that the same emotion (fear) may have an activating influence in the awareness stage, but a deactivating influence in the contemplation stage. Thus, to understand the role of blends of emotions on green innovation (non)adoption, we propose adopting a processual view and examining their emergence and action tendency in the different stages of the innovation adoption process. More formally, we ask *RQ2. How do blends of emotions change over the course of the innovation adoption process?*

This exploratory study aims to provide an answer to these questions. Specifically, we focus on sustainable, green, or low-carbon energy innovations. The energy sector is undergoing an enormous decarbonization transformation (Papadis and Tsatsaronis, 2020). This low carbon transition demands that consumers adopt a set of sustainable innovations, such as smart appliances, EVs, solar panels, or heat pumps (Adams et al., 2021; Hope et al., 2018), making the energy transition revolve around innovation adoption (Martiskainen and Sovacool, 2021). Although some studies have examined how emotions influence citizens' evaluations of energy policies (Contzen et al., 2021; Perlaviciute et al., 2018), energy infrastructures (Vrieling et al., 2021), or energy services such as flexibility provision (Adams et al., 2021), this work has omitted an examination of consumer blends of emotions throughout the adoption process and is thus an appropriate context for the research questions posed in this study.

An inductive, interpretive method was selected to respond to the research questions. This method seems adequate as this is an exploratory study, aiming for theory development rather than theory testing (Bryman, 2016). Specifically, phenomenology, or the study of the situated experiences of consumers, was chosen as a suitable method to understand the subjective experience of individual actors in transitions (Martiskainen and Sovacool, 2021; Upham and Gathen, 2021). The analysis of in-depth interviews with 23 consumers in three countries unearths the blends experienced by consumers in the different stages of the innovation adoption process and identifies four action tendencies of these blends: activation, deactivation, paralysis, or spillover. The findings also demonstrate the complex and intricate relationships between emotions and innovation (non)adoption: the same emotion may enable or hinder innovation adoption, depending on the stage in the adoption process and/or depending on the other emotions concurrently experienced by the individual. This paper extends existing scholarship on emotions and sustainable transitions, provides suggestions for using emotional frames to facilitate green innovation adoption, and proposes new research questions and methodological tools to better explain the emotional complexity surrounding micro-transition processes.

## 2. Conceptual framework

### 2.1. A conceptualization of emotions

Emotions are complex affective reactions experienced when individuals confront an event, object, or an idea and assess whether it facilitates or blocks their goals, worldview, or well-being (Carver and Scheier, 2001; Huijts et al., 2022). As a result of this assessment, discrete emotions emerge (Roseman et al., 1990). Emotions are different from other affect-laden constructs. They are different from attitudes, as the latter denotes a “summary evaluation of an object” (Ajzen, 2001, 28), having valence but not arousal (Ajzen, 2001). Emotions are also different from moods because moods lack cognitive content and are not intentional or tied to a specific target (Steinert and Roeser, 2020).

Discrete emotions can be differentiated by their valence, content, and action tendency. First, emotions differ in their positive or negative valence. Positive emotions (e.g., pride, satisfaction, or joy) are usually associated with pleasant, goal-congruent events, and the opposite occurs for negative emotions (e.g., shame, anxiety, or sadness). Second, emotions are differentiated based on the appraisals or cognitive content they encapsulate (Lazarus, 1991; Lerner et al., 2015; So et al., 2015). For instance, both anger and fear are negative emotions elicited by contexts perceived as blockers to one’s goals; however, anger is associated with appraisals of high certainty and control over the context, and fear with appraisals of low certainty and control (Lerner et al., 2015). The content of discrete emotions is relevant, as it plays a part in the actions mobilized by discrete emotions (for a catalog of emotions and a description of their cognitive content and influence on sustainable innovation adoption, see Martiskainen and Sovacool, 2021 or So et al., 2015). Although emotions are transient or short-term, their influence on decision-making lingers after the emotional episode has concluded (Lerner et al., 2015; Pham, 2007), as they lead to apprehending objects or ideas “in a specific evaluative light” (Steinert and Roeser, 2020: 301).

Third, emotions differ in their action tendency or the behavioral disposition that each emotion stimulates (Frijda, 2007). These action tendencies are usually summarized into two broad types (Frijda, 2007): approach or avoidance/withdrawal. Approach tendencies reflect a disposition to engage with an object or idea (i.e., open up, rapport), while the opposite occurs with withdrawal tendencies (i.e., disengage, detach) (Rothman and Melwani, 2017). The relationship between emotions and action tendencies is not necessarily unidirectional and mechanistic, meaning that if such an emotion is experienced, the ensuing action would not inevitably be carried out (Frijda, 2010). The action tendencies imbued in emotions should be understood as dispositions that may not necessarily be enacted (Valor et al., 2022b). Rather, individuals usually assess the acceptability and availability of a course of (in)action (Frijda, 2007) and these considerations may lead them to regulate their emotions to fit in with the contexts where they live (Hochschild, 1983; Thoits, 1989) or to balance their multiple goals (Frijda, 2007; Lowe and Ziemke, 2011; So et al., 2015). Emotions again take part in this assessment because individuals anticipate the emotions that will be experienced if they choose a given course of action (Lowe and Ziemke, 2011). If a negative outcome or emotion is anticipated, individuals may abandon the course of action or regulate the primary emotions felt (Valor et al., 2022b), so that these primary emotions morph into secondary emotions (So et al., 2015; Wood and Moreau, 2006).

Research on emotions and innovation adoption has provided evidence of emotional regulation (Valor et al., 2022b). In their seminal paper, Mick and Fournier (1998) demonstrated how consumers employed a set of coping strategies to regulate the anxiety experienced toward new technologies, because using these technologies was instrumental to their achievement of cherished goals. In the context of sustainable innovation adoption, some studies have also shown that consumers employ coping strategies to regulate their emotions vis-à-vis innovations (Bingen et al., 2011).

### 2.2. Blends of emotions

Individuals typically experience mixed emotions or blends of emotions when confronted with an event, object, or idea (Fong, 2006; Rothman and Melwani, 2017; Watson and Stanton, 2017). Emotions in a blend may be similar or dissimilar in valence, cognitive content, or action tendency (Rothman and Melwani, 2017). The experience of blends of emotions is due to manifold factors. First, emotion regulation is one of the reasons for emotional complexity (Steinert and Roeser, 2020). Coping strategies for emotion regulation usually involve the mobilization of secondary emotions (Mick and Fournier, 1998; So et al., 2015) that enrich or enlarge the blend. Second, the multifaceted nature of *stimuli* that trigger emotions is another reason for complexity (Rothman and Melwani, 2017; Martiskainen and Sovacool, 2021). Consider, for example, the installation of solar panels. Many potential emotional triggers are involved in this decision (e.g., the technology, the alternative technologies, the installers, the energy service company, the significant others of consumers, or the house). Consequently, individuals likely experience mixed emotions toward these innovations (Valor et al., 2022b). Finally, individuals are exposed to multiple, often contradictory, social representations of energy innovations (Upham and Johansen, 2020). These representations mobilize disparate appraisals of energy innovations and elicit mixed emotions (Cousse et al., 2021; Upham and Johansen, 2020).

Despite the centrality of blends of emotions in adoption processes (Martiskainen and Sovacool, 2021; Valor et al., 2022b), the relationships of emotions in a blend and how they combine to hinder or facilitate innovation adoption have been limitedly studied. Some studies have noted that consumers experience mixed emotions and attributed consumer non-adoption to this ambivalence (Onwezen et al., 2019; Sirieix et al., 2017). This work then suggests that mixed emotions have a paralyzing relationship for consumers. Yet, other studies examining the relationship between two emotions show that mixed emotions may also drive innovation adoption. For example, in their study of insect-based food Tuccillo et al. (2020) found that the emotion of excitement could override the emotion of disgust and favor adoption of this novel food technology. Similarly, Lin et al. (2020) demonstrated that even if anxiety toward an

innovation is high, if hope is also high, consumers may adopt the innovation. Taken together, this work shows that blends of emotions may have disparate action tendencies depending on how emotions in the blend are related to one another.

### 2.3. Blends of emotions in the innovation adoption process

Innovation adoption is conceptualized as a staged process (Zenobia and Weber, 2013). It typically starts when consumers gain awareness of a given innovation. Then, individuals assess whether or not they should adopt the innovation (consideration or contemplation stage). If they adopt it, the next stage consists of learning or taming the technology (Arts et al., 2011) until the use of the innovation is routinized. In practice, these stages may not progress linearly but in a disorderly way, with feedback loops or regressions to the initial stages (Valor et al., 2022b; Zenobia and Weber, 2013). To illustrate, contemplation of the adoption of an energy-related innovation such as solar panels may also contribute to raising awareness about other green energy innovations (e.g., heat pumps or EVs). Similarly, a negative evaluation of a potential solution (e.g., solar panels) may lead to considering and assessing a replacement innovation (e.g., domestic windmills). Thus, although useful as analytical devices, the boundaries among stages may be fuzzy in the real experience of consumers (Zenobia and Weber, 2013).

It is plausible to assume that consumers experience blends of emotions in each of these stages for the reasons set out above. Negative emotions toward existing problems may prompt consumers to direct their attention to potential solutions, thus gaining awareness of innovations. In the contemplation stage, emotions will play a role in the evaluative assessment of the alternatives (Arts et al., 2011; Valor et al., 2022b). Since innovation adoption may compromise other goals in the individual's goal system, emotions will assist individuals in evaluating and choosing energy innovations (Martiskainen and Sovacool, 2021; Sahakian and Bertho, 2018). Finally, emotions will be involved in habituation by signaling to consumers whether their goals have been achieved or not (Lazarus, 1991). The blends experienced at each stage, the action tendency of these blends, and the structural relationships among the emotions forming the blend are what this research aims to unveil by means of an inductive, exploratory study.

## 3. Method

### 3.1. Methodological approach

Since this paper aims to understand the emotions experienced by consumers, a phenomenological perspective was adopted (Thompson, 1997). Emotions are elicited by the individual's interaction with the social context he or she inhabits (Lazarus, 1991). Phenomenology seems appropriate (Martiskainen and Sovacool, 2021) because it acknowledges this interaction and tries to make sense of the patterns reflecting the individual's situated experience. In this inquiry, the unit of analysis is the text of consumers' stories (Thompson, 1997) about their (non)adoption of green energy innovations and their own explanations regarding how and why they adopted (or not) (Upham and Gathen, 2021). Narrative analysis is considered an appropriate means to examine emotions, particularly blends of emotions (Steinert and Roeser, 2020).

### 3.2. Recruitment of informants

Consumer stories were obtained by means of 20 in-depth interviews with 23 individuals targeted by local energy organizations in three countries: Croatia (6 interviews), Spain (6 interviews), and the United Kingdom (8 interviews). Although the choice of these

**Table 1**  
Description of informants.

Pseudonym	Country	Gender	Age	Role
Marko	Croatia	Male	40	Married with two children, lives in a condominium.
Josip*		Male	53	Married, lives in a condominium.
Stjepan		Male	40	Married, lives in a detached house.
Lucija*		Female	26	Single, lives in a condominium with her parents
Ema*		Female	28	Married with a child, lives in a house.
Sara*		Female	26	Single, lives in a condominium with her parents
Guillermo	Spain	Male	Mid 40s	Lives with his partner in a detached house
Pedro and María		Male, female	Early 50s	Married, an adult sibling, live in a detached house.
Francisco and Luisa		Male, female	Late 40s	Married, two teenagers, live in a detached house.
Juan*		Male	Late 40s	Married, two children, lives in a condominium
Jose		Male	Early 40s	Divorced, two children, lives in a condominium
Javier		Male	Mid- 50s	Divorced, lives in a detached house (designed by himself)
Bryn*	United Kingdom	Male	78	Married, lives in a house.
Michael		Male	38	Married, two kids, lives in a house
David and Susan		Male, female	Early 70s	Married, no kids, live in a detached house
Paul		Male	Early 70s	Single, lives in a terrace house
Oliver		Male	70	Married, lives in a detached house
Olivia*		Female	40s	Single, lives in a condominium
Rony*		Male	40s	Divorced, two children, lives in a condominium
Harry		Male	50s	Married, with two teenagers, lives in a detached house

countries is driven by convenience, they exemplify different energy transition processes where green energy innovations are institutionalized differently (Mata Pérez et al., 2019). Recruitment of participants was carried out by a local energy cooperative, following a purposive sampling strategy (Strauss and Corbin, 1990): a list of profiles was provided and, using convenience sampling, local organizations contacted individuals who matched the profile from among their base of prospects. Although the informants reflected the population being served by local energy organizations, the informants varied in age, sex, and life-cycle stage (Table 1). Furthermore, informants were in different stages of innovation adoption, depending on the innovation. Seven of the informants had not (yet) adopted a green energy innovation. This variability is essential for the constant comparison process (Locke, 2001; Strauss and Corbin, 1990) as it guarantees that asymmetries can be captured in the underlying patterns. Nonetheless, the interviewees are not representative of the population of each of the countries, which limits the generalization of results. Given the exploratory nature of the study and its aim for theory development rather than theory testing (generalization or prediction), this form of sampling seems adequate as it ensures the diversity of sociodemographic profiles and cultural settings on which the explanation is based.

### 3.3. Interview guide and data collection

A conversation guide was used so that the interview was semi-structured and conversational, following the recommendations for phenomenological interviews (Thompson, 1997; Upham and Gathen, 2021). The conversation progressed through three blocks. First, participants were asked to describe themselves (occupation, hobbies, life goals, etc.). Next, participants were asked to talk about their perception of energy and the energy transition and to explain the changes (if any) they had implemented. Finally, they were asked about their relationship with green energy innovations (PV panels, EVs, heat pumps, smart appliances). All interviews in the UK were conducted online due to the lockdown in place at that time. In Croatia and Spain interviews were conducted offline, except for one (Jose). Interviews lasted between 1 and 2 h and were recorded and transcribed for analysis. We followed strict ethical guidelines for informed consent and personal data protection, including the anonymization of the quotes reported in this document.

### 3.4. Procedures for the analysis

The analysis combined procedures from hermeneutics (Thompson, 1997) and grounded theory (Strauss and Corbin, 1990). The first author read each transcript several times, trying to understand each part and its connection to the whole (Thompson, 1997). Next, each interview was coded for the stage of the innovation process at which the consumer claimed to be for every innovation discussed. Then, each interview was coded for the emotions reported, the elicitors of these emotions, and the declared present and future action toward the innovation. The primary codes for each interview were then compared, using a constant comparison matrix to identify data patterns. This process allowed an emerging model to be identified that described blends of emotions in three key stages: *problem identification*, *search for solutions*, and *action*. Once this model was outlined, the interviews were re-analyzed to refine and saturate the initial model. Then, the same matrix was used to infer the internal relationships of the emotions in the blends vis-à-vis their action tendencies; this analysis led to identifying four possible internal relationships of the emotions forming the blend. The analysis was then discussed with the second and third authors until the core themes in the findings stabilized.

To identify and label the emotions, we followed the procedures used in past studies (Gopaldas, 2014; Sirieix et al., 2017), using both verbal and nonverbal displays of emotions. As emotion discourse analysis has shown (Edwards, 1999), emotions can be expressed in manifold ways other than saying “I am angry.” Emotions are often expressed indirectly (e.g., “This is outrageous” is a way of expressing anger) or metaphorically (e.g., “I boiled with rage”). Also, individuals differ in their emotional expressivity (Van Kleef, 2016). We observed great variability in the way emotions were reported: some informants did not refer specifically to discrete emotions but claimed to feel good or bad, and/or phrased their feelings indirectly. Due to this condition, researchers had to pay close attention to the nonverbal emotional displays used by informants to report their experiences and ensure that they maintained an interpretive stance to infer the emotions embedded in consumers’ narratives (Edwards, 1999; Sahakian and Bertho, 2018). To this end, in addition to the transcripts, researcher notes and recordings were used; specifically, attentiveness to facial expressions, voice and gesturing was fundamental to identifying the emotions reported by informants (Gopaldas, 2014). Although online interviews limited the visualization of complete body movements, they could capture facial expressions, voice pitch, and gestures that constitute fundamental modes of emotional expression (Van Kleef, 2016).

## 4. Findings

We first describe the emotions experienced in the three stages identified and how they modulate the innovation adoption process. It merits mention that the relationships between blends and action rely on associations inductively identified in consumer narratives or explicitly made by consumers. Then, we explain the internal relationships between emotions in a blend and, of these emotions, with the overall action tendency of the blend. Specifically, we find four possible relationships between emotions in a blend (synergic, counterbalancing, ambivalent, and spillover) and four possible action tendencies of the blends (adoption, rejection, postponement, permutation).

### 4.1. Blends of emotions at the problem identification stage

The analysis unearths two blends of emotions at this stage with two disparate action tendencies. The first blend (activating) is mobilized when users realize that their current situation vis-à-vis energy is problematic, thus enabling progression to the next stage (a



search for solutions). The second blend (deactivating) is observed among consumers that do not contemplate adopting green innovations.

The activating blend comprises four emotions: worry/anxiety, control-related emotions (carefree or calm), moral anger, and guilt. Consumers report feeling worry/anxiety due to anticipation of future energy prices or supply cuts (e.g., Stjepan: “the prices of natural resources are rising... by natural resources, I mean gas, electricity, water, and in the future, they will become more and more expensive;” Paul: “So I think there’s a real risk that with more extreme weather events, we’ll have more storms, and we’ll have more power cuts. So, I think, I think looking over the next 10 or 20 years, there is a real risk that we’ll have less reliable public utilities”). This anxiety signals to individuals that other cherished goals will be compromised and motivates individuals to find innovations to secure a reliable and affordable energy supply. “We have more and more devices that use electricity: cell phones, laptops, the kitchen robot... We wanted to make sure that we could operate them,” said Pedro when explaining what prompted him to adopt solar panels (similarly, Stjepan and Paul).

Worry or anxiety not only signals that a key resource may be jeopardized, but also that will be consequent experiences of stress and discomfort. Regaining control by reducing their dependence is fundamental to experiencing calmness and/or avoiding future stress. As reported by Stjepan: “[What I want is that] I don’t have to worry about anything. I can live with peace of mind and use all the devices I need.” Anxiety avoidance or calm-seeking emerges as an emotion involved in problem identification and the search for solutions. Ema’s narrative, still in the contemplation stage, points to calm-seeking or anxiety avoidance as emotional triggers of her desire for solar panels: “We never know when Russia is going to close our gas line. We don’t have enough gas in Croatia, and I don’t want to depend on it.”

Environmental degradation is an emotional trigger in the awareness stage. Whereas some informants phrase their emotions about environmental degradation as fear or worry (e.g., Michael, David-Susan, and Ema), others display feelings of moral anger when discussing environmental problems, especially when they engage in blame attributions. For some informants, environmental degradation is a consequence of our consumerist lifestyles and the inaction of actors—notably, governments and large utilities—that nonetheless have a primary responsibility to act upon the problem. However, whereas some consumers tend to blame other actors, some consumers also direct blame on themselves; these consumers report feelings of guilt, insofar as they attribute environmental degradation to their personal actions. Contrast here the narratives of Olivia and Michael. Olivia blames the inaction of the national government and large utilities in enabling the deployment of innovations to decarbonize the electricity system. However, she does not feel guilty about driving a fuel-operated car or using gas-operated heating. To explain her lack of guilt, she says: “I need to stop blaming that and sort it out... not externalizing blame, I suppose. Just taking responsibility for changing and being a different person.” In contrast, Michael also expresses moral anger at governments and utilities (“But I guess my biggest feeling is that there isn’t anywhere near the kind of emphasis on improving the energy grid that I feel there should be. The rate of progress seems to be woefully inadequate, really”). In contrast to Olivia, he does experience guilt when using appliances or lighting. He is conscious that these mundane actions are carbon intensive; adoption of low-carbon innovations is a way for him to suppress these feelings of guilt (“I guess, really, it’s that bit of guilt that I feel whenever I press a button, which is going to consume electricity. If I could reduce that feeling more...”).

The deactivating blend is explained by the experience of contentment, joy, and satisfaction. This blend is experienced by consumers that have not gone past this stage. Specifically, this blend is manifested when consumers acknowledge that environmental problems are not an issue and/or that their current energy-related practices are satisfactory. For instance, Josip says: “We have very little pollution in the environment and water. We have a very clean environment in Croatia and there are no indications it could become polluted in the future.” This explanation is provided prior to explaining that he has not adopted any sustainable energy innovation. It is plausible that these emotions are secondary or self-regulated, enacted to avoid dissonance or justify non-action, as satisfaction with their present state frees individuals from the “hassles” of searching for a solution. However, whether these positive emotions are primary or secondary emotions is less relevant than their action tendency: they arrest the innovation adoption process.

#### 4.2. Blends of emotions in the search for solutions

A blend of anxiety, guilt, pride, excitement, and calmness/control seems to drive attention to energy-related technologies and facilitate adoption. The constant comparison matrices reveal some links between the specific emotions involved in the previous stage and the specific solution searched for. Anxiety is noted in the consideration of self-producing technologies (this is the case of Marko, Stjepan, Pedro, and Paul), probably because the adoption of these technologies is sufficient to achieve their goals and suppress negative emotions. In contrast, guilt is also mobilized in the engagement with other actions that do not demand the adoption of technology (we label this action tendency permutation), such as energy-saving practices, changing to green energy suppliers or retrofitting (Michael, Oliver, David and Susan, Pedro and Maria). This is consistent with other works showing the positive influence of guilt on adopting greener solutions such as LED lights (Moghavvemi et al., 2020).

Also, anticipated pride and/or anticipated admiration from others drive attention toward certain energy-related solutions. This is consistent with past studies demonstrating that status seeking can be a motivational force for adopting energy innovations (Noel et al., 2019). When Oliver, a now-retired IT project manager, explains their decision to buy an EV some years ago, he says: “I love technology; it was exciting to think about an electric car. It seemed like the future. (...) And now our electric car, could I say, looks mundane. It doesn’t turn heads anymore. But when we first got it, people pointed as we went by. I enjoyed that” (similar stories were reported by Stjepan and Paul). Intermingled with admiration, anticipated pride and excitement at learning about new technologies emerge as an emotional drive in searching for energy-related solutions, as Paul reckons he feels good due to “being an early adopter and finding out about the technology and how it works and what it does” (similarly Javier and Francisco).

Finally, calm or feelings of control are emotions usually reported by consumers that have adopted an innovation. Marko reports, “I

have a smart thermostat and it works great. You don't have to worry about it. You don't have to worry about anything" (similar stories are reported by Oliver, Paul, Guillermo, and Jose).

Two blends of emotions may also halt the adoption process at this stage. First, the non-adopting consumers report desire or eagerness to adopt photovoltaics (PVs), but also anxiety or stress. This is a blend that can also be found in past studies (Brown and Markusson, 2019; Hope et al., 2018). Much as consumers desire to install PVs to reduce their carbon footprint, the anticipated anxiety associated with the financial investment required, the bureaucratic process they must put up with, or the hassle involved in "taming" the technology may eventually lead to a negative evaluation of PVs. The feelings triggered by the perceived complexity of innovations negatively affects their adoption (Clausen and Fichter, 2019), regardless of their usefulness. This is not surprising given that anticipated anxiety leads individuals to prefer low-risk/low-reward options (So et al., 2015). Ema repeatedly expresses her desire to have PVs to reduce her carbon footprint and gain self-sufficiency. When asked about what stops her from doing it, she says: "If I could be sure that I would get the promised amount of money and if I wouldn't have to bother too much with the paperwork or spend a lot of money and time on it (...) and I wouldn't have to worry about anything, about a possibility of a malfunction or disaster." Anticipated stress or anxiety can be inferred from her narrative as the main reason for not installing PVs. Similarly, several informants (Bryn, Pedro, and Maria, Harry) reported considering the installation of low-carbon energy technologies, but anxiety about the potential dysfunctions of what they see as technologies-in-progress and/or the disruption associated with major works in the building lead to despair and eventual rejection (or postponement) of this technology. Only consumers that had working experience in energy (e.g., Paul and Javier) or IT (e.g., Stjepan, Francisco, and Oliver) do not report anxiety towards energy-related technologies.

Second, a blend of desire and guilt also emerges as a reason for postponing adoption when consumers assess the overall environmental impact of energy-related technologies. For instance, Pedro and Maria report having discussed replacing their heater with another, more efficient one. Although they desire this appliance for its reduced energy use, they also think throwing away usable equipment is a waste that creates other problems in the landfill (a similar blend is reported by Guillermo and Harry). Thus, the desire to reduce their energy conflicts, combined with their guilt about creating technological waste, led to postponing their acquisition of a more efficient heater.

#### 4.3. Structural relationships of emotions in blends

The analysis shows that the emotions forming the blends combine to produce four possible action tendencies toward innovations: adoption, rejection, postponement, or permutation. Analytically, four relationships among emotions in the blends seem to be associated with these action tendencies, i.e., synergic or reinforcing, counterbalancing, ambivalent, or spillover relationships (Table 2).

*Synergic relationships* among emotions in a blend occur when individuals experience emotions with similar action tendencies. Since synergic relationships were observed in the blends experienced by consumers who adopted them, it is plausible to defend that when emotions in the blend have synergic relationships with one another the informational and motivational influence of emotions accrue, facilitating innovation adoption. A synergic or reinforcing relationship is found among anxiety, calmness (or absence of anxiety), moral anger, guilt, pride, or admiration from others. This combination is involved in raising awareness of the negative impact of their energy practices (anxiety, moral anger) and in greater individual *responsibilization* (guilt). Moreover, this blend is mobilized in positive assessments of energy technologies as they elicit pride and admiration.

In contrast, a *counterbalancing* relationship is found when one emotion may suspend or block the action tendencies enabled by another emotion. Or stated differently, the potential activating role of some emotions is halted by experiencing another emotion. Emotions with counterbalancing relationships observed in non-adopting consumers are involved in their rejecting adoption. Even when consumers may experience anxiety or moral anger, if they also experience contentment with their current energy appliances, the action tendencies of anxiety/moral anger are suspended. This blend is specifically observed among consumers who experience contentment and pride after innovation adoption. Because these emotions signal that goals are met and provide a sense of achievement (So et al., 2015), experiences of contentment/pride seem to suppress the thrust for the adoption of other innovations. The story of Marko is illustrative; he says: "I don't think I would change anything. We have reached an optimal level of energy use." After installing smart plugs and a smart thermostat, he had met his goal of reducing energy use with non-stressful solutions. Thus, his satisfaction with the adopted appliances is involved in his unwillingness to consider other energy-related innovations. This counterbalancing relationship may also explain the thresholds in energy savings identified in past studies (Brown and Markusson, 2019).

Anxiety or stress may also counterbalance other activating emotions, and, as a result, consumers may reject adopting other

**Table 2**

Structural relationships of emotions in the blends.

Structural relationships	Examples of blends of emotions	Action tendencies vis-à-vis energy innovations
Synergic	Anxiety, calmness, guilt, curiosity, pride, or admiration from others	Adoption
Counterbalancing	Emotions that have a counterbalancing influence of other emotions: contentment/pride, anxiety, or relational emotions.	Rejection Adoption
Ambivalence	Desire and anxiety/frustration	Postponement or search for new solutions
Spillover	Contentment/pride and guilt Activating emotions and frustration	Permutation/adoption of another innovation or of practices not requiring innovation adoption

innovations. Paul envisages that as soon as he has adopted PVs, an EV, and a battery, he will not bother with other innovations enabling flexibility provision, such as smart plugs or smart appliances. He says: “you know, when I install the other things that will be the extent of it. (...) I’m not one of those people who puts on my washing machine during the nighttime, or on a timer. So, I just tend to use things when I want to. And even though they’re slightly more expensive, I just, we’re just getting on and do it. (...) But I think I think for me at the moment, I think some of those things would be seen, like inconveniences for small savings” (similarly, Lucija). This case also illustrates that contentment/pride and anticipated anxiety may be emotions mixed up in the noted moral disengagement from energy technologies (Venugopal and Shukla, 2019).

The opposite may also occur, so that an emotion counterbalances the action tendencies of deactivating emotions, thus facilitating innovation adoption. The story of Jose is illustrative: his initial frustration and stress with the night storage heaters were easily circumvented by his anticipated pride about using energy with fewer emissions. Or, in other words, his eagerness to have a green lifestyle (and the potential pride elicited by his actions) made him regulate the experience of frustration and discomfort so that these deactivating emotions were suppressed.

The third relationship among the emotions forming the blend is *ambivalence*. Although anxiety counterbalances other activating emotions in the case discussed above, it may also combine with other emotions in an ambivalent or paralyzing relationship. For instance, ambivalence is noted when consumers simultaneously experience desire for, curiosity, and anxiety toward the same energy technology. Ambivalence may result in either postponement or permutation, so that consumers search for other solutions that may appease their activating emotions without creating heightened levels of anxiety.

Although consumers experiencing ambivalence apparently remain paralyzed or inactive, they may actually be actively screening the environment to find the right *momentum* to adopt, namely, when the anticipated anxiety will be lessened. Consider the case of Pedro and Maria: involved in environmental movements since they were young, they built their own house when they got married 20 years ago. At that time, they considered installing PVs; yet unclear regulations and installation prices triggered anxiety. After 20 years, they eventually installed their much-desired PVs. A similar story is shared by David and Susan (“We have solar panels, and we only got them recently. But we did think about it for a long time. We have an electric car. And we thought about that for quite a long time”) or Stjepan (“I considered it [installing PVs] for 10 years”).

Relational emotions or feelings (Thoits, 1989) (support, protection, or trust) seem to play a part in resolving ambivalence: these paralyzed consumers made the decision when they found other consumers with whom they could adopt together. Collective adoption of energy technologies appeased their anticipated anxiety for two reasons: because collective installations were cheaper and, more importantly, because the group shared the emotional burden of going through the procedure. David and Susan explain how a collective installation increased relief and decreased their anxiety:

*Several solar panel installers have gone out of business, disappeared without a trace. So, we wanted to be sure that they would be around to help in the future if anything went wrong. And again, if you do something as a community, you have this feeling of support and protection. It might be, you know, made of sand, but that was a part of it. You had to check. Everyone was checking their credentials. Yeah, you weren't on your own.*

Thus, relational emotions may also operate as a counterbalancing emotion that helps resolve ambivalence.

Finally, a fourth relationship, labeled *spillover*, is observed among emotions. We said that contentment and pride seem to suppress the inclination to adopt that are enabled by other emotions, such as curiosity, fear, or anger. However, contentment and pride may also lead to spillovers if the actions taken by consumers are not enough to appease the guilt. The story of Michael is very illustrative. He has installed PVs on his farm, bought an EV, contracted a green energy supplier, and engaged in major energy-saving practices such as not using the heating for a year or shifting consumption to off-peak hours. He explains these accomplishments with pride. However, he also acknowledges experiencing guilt every time he uses electricity. In this case, contentment/pride and guilt have a spillover relationship as they drive consumers to consider adopting other innovations. Spillover is also found in the stories of David and Susan, Oliver, and Guillermo: their adoption of energy solutions has elicited pride and contentment, but as they still experience guilt for their environmental impact, they are considering other innovations to further decrease their carbon footprint.

Spillover relationships are also found in the blends of desire and frustration. This is the case of Olivia and Rony: they experienced frustration for not being able to adopt self-producing technologies, more efficient appliances, or cleaner heating systems, because their housing arrangement (renting) did not permit it. However, their desire to produce less environmental impact with their practices was not suppressed; as a result, they turned to implementing energy-saving practices and easy-to-implement retrofitting solutions. In this case, the spillover relationship among emotions led to permutation or consideration of other innovations or practices as a replacement.

## 5. Discussion and conclusion

Aiming to enrich our understanding of how mixed emotions play out in the innovation adoption process, this study has unearthed blends of emotions involved in problem recognition, the search for solutions, and action stages. Moreover, it has conceptualized four possible action tendencies of these blends: adoption, rejection, postponement, and permutation. These overall action tendencies are explained by the relationships that emotions in the blend have with one another, namely synergic, counterbalancing, ambivalent or spillover.

This study has several implications for both theory and practice. First, this study provides insights for transition scholars and especially for those more interested in the role of emotional psychological processes. The study shows the intricate and complex relationships between emotions and consumer innovation (non)adoption, since the same emotion can have disparate influences depending on the consumer’s stage and the other emotions experienced by the individual. This suggests that examining a single or a



reduced set of emotions in isolation, or grouping emotions by valence, may not help explain (predict) actual (future) innovation adoption. To illustrate, although guilt is a negatively-valenced emotion, it activates consumer inclination to adopt energy innovations, especially when combined with other emotions such as anxiety or anticipated calmness. Pride is also experienced in the contemplation of energy innovations but, after adoption, pride may lessen the inclination to adopt other sustainable innovations.

This study unveils a *palette* of discrete emotions experienced in each of the stages of the adoption process, providing a more granular description of the positive emotions that can be related with favorable attitudes (Marrero et al., 2021) or dispositions to adopt (Hope et al., 2018), such as pride, admiration, calm, or curiosity/excitement. Although the blends of emotions experienced by consumers seem to be ideographic, we do find some patterns that can be leveraged to enable progression in the change process. To illustrate, in the contemplation stage, it seems fundamental to elicit negative emotions such as anxiety, moral anger, or guilt so that consumers face a dilemma in their current situation and direct attention to energy innovations. However, when considering specific solutions, anxiety or guilt may be involved in ambivalence and paralysis and, thus, they may negatively influence innovation adoption. The findings also reveal the emotional implications of the trade-offs consumers face when trying to lower their energy carbon footprint (Brown and Marksson, 2019), but they suggest that eliciting guilt may help resolve the ambivalences or spur spillovers, resulting in greater innovation adoption or engagement with sustainable practices. They also provide evidence of the role of emotion regulation in innovation adoption: emotions associated with perceived risks or discomforts—fundamental barriers in innovation adoption (Sanguinetti et al., 2018)—can be regulated when other secondary emotions are elicited (e.g., anticipated pride).

Second, the study offers actionable insights for transition scholars and practitioners, as understanding blends of emotions and their action tendencies can be leveraged in change processes. More specifically, the findings suggest that emotional appeals aiming to elicit (suppress) emotions could effectively aid in fostering innovation adoption. Such appeals should be adapted considering the structural relationships identified among emotions in the blends (e.g., if consumers experience contentment, appeals of guilt may counterbalance the deactivating influence of contentment).

Third, the findings also reveal several methodological considerations for future work. Our analysis of the blends of emotions suggests that emotions operate in configurations. Given the interpretive method followed, we cannot test whether these configurations can be generalized to explain innovation adoption. Future studies could use configuration analysis for this purpose. Configurational analysis is an increasingly popular approach for obtaining solid and rigorous evidence of which configurations of attributes (in this case, discrete emotions) work together to explain an outcome of interest (Furnari et al., 2021). Configurational causation relies on assumptions of equifinality—attributes may combine in different ways to produce an outcome—and asymmetry—outcomes may occur due to the presence or the absence of an attribute—(Furnari et al., 2021). These assumptions seem to apply to the study of emotions and consumer engagement, as this research has revealed. We have provided evidence of equifinality, showing that the adoption of energy technologies may stem from a combination of fear and calm, or anger and guilt. Similarly, we have shown that some emotions need not be present (e.g., anxiety or pride) as they may have a counterbalancing relationship with other activating emotions. Configurational techniques may be suitable to test the causal relationships that this study can only suggest.

Also, this study may lead researchers to be more cautious with conclusions drawn from cross-sectional studies regarding the actions consumers will take vis-à-vis a particular technology or energy-related practice. We have shown that ambivalence may lead to rejection and postponement—which may last for years—or to the performance of other pro-environmental actions. Future work could include more granular measures of actions that better reflect the decisions to reject, postpone, or permute that were found in this study. This differentiation in action outcomes could help better predict different energy technology transition and diffusion paths.

Finally, this study opens fruitful lines of work. To our knowledge, experimental studies on the effectiveness of emotional appeals to enable green innovation adoption are scarce. Future research could therefore test emotional appeals to better understand which appeals work for which solutions and for which types of users (Martiskainen and Sovacool, 2021), using the insights provided by this study. Similarly, future works could examine the relationships between emotions at the meso-level (e.g., the emotional frames depicted in social media) and the consumers' experienced blends over time and their subsequent effect on energy innovation adoption.

No study is without limitations. The interpretive method does not allow for establishing causal relationships; testing the causal effects of the blends on innovation adoption is a matter for further research. Although we followed the habitual procedures for examining emotions in phenomenological interviews (Edwards, 1999; Gopaldas, 2014), the context of data collection (online interviews and use of masks by some informants) may have limited the ability of researchers to precisely identify the nonverbal communication of informants. Likewise, we cannot be certain that the reported or displayed emotions correspond to those truly felt by the informants. Future research could examine the role of other emotions not reported by informants, such as envy or shame, on green innovation adoption. Similarly, the emerging conceptual model of blends of emotions is based on a small sample of informants and cannot be generalized to other cultural settings or other green innovations. Finally, despite the relevance of perceived efficacy in the adoption of green innovations and behaviors, our findings did not specifically examine the emotional experiences that co-arise, facilitate, or result from perceived effectiveness; this could be an interesting line for future work.

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## Ethics statement

Informed consent was obtained from all participants. The design of the study was assessed and validated by TIMELEX to ensure that

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## CRedit authorship contribution statement

**Carmen Valor:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Juan Martino:** Investigation. **Leonor Ruiz:** Investigation.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

Data is available to researchers upon motivated request to the corresponding author.

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