



# Analysis of the influence of emotions on the decision-making of entrepreneurs using neurotechnologies

Juan Camilo Serna-Zuluaga<sup>1</sup> · David Juárez-Varón<sup>1</sup> ·  
Ana Mengual-Recuerda<sup>1</sup> · Ana Medina-López<sup>2</sup>

Accepted: 19 February 2024  
© The Author(s) 2024

## Abstract

This study examines the influence of emotional factors on entrepreneurial decision-making, specifically focusing on early-stage entrepreneurs and those with more years of experience in the entrepreneurial process. The aim is to understand how emotional intensity affects business decisions at different stages of entrepreneurship. Neuroqualitative interviews were conducted using a stratified sample of entrepreneurs. The methodology included semi-structured interviews. Galvanic Skin Response (GSR) technology was employed to simultaneously measure participants' emotional levels during the interviews. The results revealed significant differences in emotional levels between novice and experienced entrepreneurs concerning the analysed emotional factors. Novice entrepreneurs exhibited higher levels of anxiety and fear, especially in questions not previously anticipated, while experienced entrepreneurs showed confidence and a more optimistic outlook, particularly on topics related to long-term consolidation and revenue forecasting. This study highlights originality by demonstrating the importance of emotional factors in entrepreneurial decision-making and their variation over time in the entrepreneurial process. The use of GSR technology in neuroqualitative interviews adds a unique dimension by providing an objective assessment of entrepreneurs' emotional levels, thus complementing the qualitative richness of verbal responses. These findings contribute to a deeper understanding of emotional complexity in business decision-making and emphasize the need to consider these aspects in entrepreneurship support strategies.

**Keywords** Entrepreneurship · Decision-making · Temporal evolution · Emotions · Neuroqualitative · Neuroentrepreneurship

---

Extended author information available on the last page of the article

## Introduction

Emotions play a crucial role in human decision-making. Although it has traditionally been thought that decisions should be based exclusively on logic and reason, it has been demonstrated that emotions play a significant role in this process (Acharya & Berry, 2023). Some reasons justifying the importance of emotions in decision-making include their influence on the perception of information, emotions as a driving force for motivation, or as triggers for intuitive responses (resulting from past experiences). Emotions also influence the assessment of risks and rewards associated with a decision, and they are linked to the learning process (Juárez-Varón et al., 2023). Consequently, emotions are an integral part of decision-making, and studying how they influence it is key for entrepreneurs.

This study focuses on analysing the influence of emotions on the decision-making of entrepreneurs, differentiating between novices and experienced individuals. Entrepreneurship drives the economy and innovation. Understanding how entrepreneurs make decisions in different situations can improve the quality of their decisions and, therefore, their success (Cardon et al., 2013). Emotions play a vital role in decisions (Grichnik et al., 2010), particularly in entrepreneurship, where there are constant risks and challenges. Understanding how emotions affect decisions is essential. Decisions evolve with experience (Foo, 2011). Studying how novice and experienced entrepreneurs face emotions and make decisions can shed light on the skill development process (Podoyntsina et al., 2012).

The decision-making process in entrepreneurship is a complex and crucial phenomenon that directly influences the success and survival of entrepreneurs and their companies (Engel et al., 2022). However, there is a lack of understanding of how both positive and negative emotions influence the decision-making of entrepreneurs and how these influences may vary between novice and experienced entrepreneurs. This lack of knowledge limits our ability to provide accurate guidance and effective strategies to entrepreneurs at different stages of their business journey (Maresch et al., 2023). Although research has been conducted on decision-making in the context of entrepreneurship and the role of emotions in this process, there is still a need to further examine how emotions specifically impact entrepreneurs' decisions (Amess et al., 2016; Zollo et al., 2021). Furthermore, the distinction between novice and experienced entrepreneurs adds an additional layer of complexity, as their experience could influence how they emotionally handle and respond to decision-making situations (Cegarra-Navarro et al., 2023).

This study aims to fill this gap by investigating how emotions, both positive and negative, impact the decisions made by novice and experienced entrepreneurs. Through the use of qualitative interviews and the measurement of emotional responses via Galvanic Skin Response (GSR), we developed a market research technique called neuro-qualitative, seeking to explore how these emotions influence the assessment of opportunities, perception of risks, and choice of strategies at different stages of the entrepreneurial process (Juarez et al., 2020). The work is structured with a literature review on entrepreneurship, decision-making by entrepreneurs, the influence of emotions on decision-making, and how these variables change according to the entrepreneur's experience, concluding with a proposal to apply neuro-technologies

in qualitative research. Next, the methodological design is presented, where GSR technology is applied in neuro-qualitative interviews, adding a unique dimension by providing an objective assessment of entrepreneurs' emotional levels. Following the neuro-qualitative research, the obtained results are presented, comparing responses to questions and emotional responses among study groups. Finally, a series of conclusions and recommendations are drawn.

## Literature review

### Entrepreneurship and decision-making

Decision-making plays a crucial role in the context of entrepreneurship, where entrepreneurs face a wide range of decisions in identifying opportunities, developing strategies, and managing their businesses (Bao et al., 2023). Decision-making theory in entrepreneurs has explored various approaches and factors influencing this process, highlighting entrepreneurial alertness theory, which focuses on how entrepreneurs identify and evaluate opportunities (Gamero & Ostos, 2020). Entrepreneurs, drawing on non-rational models of behavioural decision theory, are more likely to use biases and heuristics in decision-making than managers (Maresch et al., 2023). In uncertain and complex environments, these biases and heuristics serve as effective and efficient guides, even being associated with innovation. This crucial difference in the manifestation of biases and heuristics between entrepreneurs and managers underscores the complexity of decision-making in the entrepreneurial domain (Bettinelli et al., 2017; Haynes, 2003).

In the emotional context, Derakhshan reveals that emotions play a significant role in entrepreneurs' decisions (Derakhshan et al., 2023). Fear may lead to risk avoidance, while anticipation drives the assumption of opportunities. Positive emotions, such as confidence and enthusiasm, impact motivation and perseverance. This finding emphasizes the multifaceted influence of emotions on the assessment and management of entrepreneurial decisions (Brundin & Languilaire, 2023). The influence of the environment and social networks on entrepreneurs' decisions is highlighted in research on the determinants of business consolidation (Jaime & Benjumea, 2022). Interactions with other actors, such as entrepreneurs, investors, and mentors, as well as access to social networks and entrepreneurial ecosystems, provide information, support, and resources influencing strategic decisions (Autio et al., 2018). This interconnectedness reflects the importance of considering the social context in entrepreneurial decision-making (Bae et al., 2014). Ethical considerations in entrepreneurial decision-making become significantly relevant when analysing the extent to which entrepreneurs employ moral imagination to incorporate ethical aspects in pioneering contexts. This approach examines the application of the concept of moral imagination, exploring how entrepreneurs use this ability to integrate ethical dimensions in situations characterized by high uncertainty. Ethics, a fundamental constituent in the decision-making process, underscores the urgent need for a deeper understanding of the ethical factors influencing the entrepreneurial domain (McVea, 2009).

In summary, decision-making in entrepreneurs is a complex process unfolding in a dynamic business environment (Camuffo et al., 2020). This analysis highlights the crucial interaction between perception, attention, memory, and reasoning—elements that shape how entrepreneurs interpret key information for strategic decision-making (Haynie et al., 2009). Understanding these dynamics reveals the inherent complexity of entrepreneurial choices and provides a solid foundation for the development of effective approaches aimed at improving decision-making and, consequently, the overall performance of entrepreneurs in an ever-evolving business landscape (Choi & Shepherd, 2003). Entrepreneurial decision-making is a complex process influenced by a series of factors, among which emotions play a significant role. Examining the impact of emotions in different phases of the entrepreneurial process has highlighted how both positive and negative emotions affect the assessment and exploitation of entrepreneurial opportunities (Grichnik et al., 2010). They find that positive emotions positively influence evaluation but negatively impact exploitation, while negative emotions negatively affect both phases. This dynamic approach underscores the changing nature of the role of emotions at various stages of the entrepreneurial process (Shepherd et al., 2011).

Emotions can act as both facilitators and inhibitors of entrepreneurs' decision-making. On one hand, positive emotions, such as confidence and enthusiasm, can motivate entrepreneurs to take risks, seek opportunities, and persevere despite obstacles (Derakhshan et al., 2023). These positive emotions can foster a proactive attitude towards goal achievement and encourage creativity and innovation (Welpel et al., 2012). On the other hand, negative emotions, like fear and anxiety, can have an inhibiting impact on entrepreneurs' decision-making. Fear of failure, for example, may lead to risk aversion and more conservative decisions (VanElzakker et al., 2014). However, it is essential to note that negative emotions can also trigger adaptive responses, such as increased caution and attention to detail (Barrett et al., 2007). Furthermore, the intensity and way in which entrepreneurs experience emotions can influence their decision-making process. Research has shown that entrepreneurs with higher emotional intelligence can regulate their emotions more effectively and make more balanced and rational decisions (Carreon 2017). The ability to understand and manage one's own emotions, as well as the ability to perceive and respond to others' emotions, can be a key factor in successful decision-making (Brundin & Languilaire, 2023).

This perspective is complemented by exploring how emotions influence entrepreneurs' risk perception (Cardon et al., 2012). They find that emotions associated with certainty and outcome control, such as anger and happiness, are linked to lower risk perception. In contrast, emotions linked to uncertainty and lack of control, such as fear and hope, are associated with higher risk perception (Dew et al., 2015). These findings underscore how emotions impact risk perception, a critical aspect of entrepreneurial decisions (Foo, 2011). A study on mixed emotions in entrepreneurs' risk perception provides an additional perspective by examining the role of mixed emotions (Podoyunitsyna et al., 2012). Focusing on emotional ambivalence, it highlights that conflicted and ambivalent emotions are important predictors of entrepreneurs' risk perception. This emphasis on ambivalence underscores the complexity of entrepreneurs' emotional responses and how they influence risk perception and,

consequently, business decisions (Bierwerth et al., 2015; Biniari, 2012). The interconnectedness of this perspective becomes evident when exploring how emotions influence entrepreneurs' risk perception. The study discovers that emotions associated with certainty and outcome control, such as anger and happiness, are linked to lower risk perception. In contrast, emotions linked to uncertainty and lack of control, such as fear and hope, are associated with higher risk perception. These findings underline how emotions impact risk perception, a critical aspect in entrepreneurial decisions. A study on conflicting emotions in entrepreneurs' risk perception adds an additional perspective by examining the role of mixed emotions. Focusing on emotional ambivalence, it highlights that conflicting and ambivalent emotions are important predictors of entrepreneurs' risk perception. This focus on ambivalence underscores the complexity of entrepreneurs' emotional responses and how these influence their risk perception and, consequently, their business decisions.

Additionally, managers' emotional expressions influence employees' willingness to act entrepreneurially (Behrens & Patzelt, 2016; Brundin et al., 2022). It reveals that displays of confidence and satisfaction by managers enhance employees' willingness, while displays of frustration, concern, and confusion decrease employees' willingness (Akehurst et al., 2009). This interpersonal approach highlights how leaders' expressed emotions affect the emotional atmosphere in which employees make business decisions. In summary, these studies underscore the relevance of considering emotions as a fundamental component in entrepreneurial decision-making. The dynamic interaction between positive and negative emotions, their impact on opportunity assessment and risk perception, along with interpersonal influence in the work environment, contributes to a more comprehensive and robust understanding of how emotions affect decision-making in the entrepreneurial context.

Entrepreneurial decision-making is a dynamic process deeply influenced by individual experience. Research focusing on differences among types of entrepreneurs emphasizes that prior entrepreneurial experience plays a crucial role in how stressors affect entrepreneurs' recovery and well-being (Kollmann et al., 2019). This perspective highlights that experience not only affects direct business decisions but also entrepreneurs' ability to cope with the stress associated with entrepreneurship. In line with this, it is revealed that experienced entrepreneurs tend to identify more opportunities and exploit those with more significant wealth creation potential (Basu et al., 2011; Ucbasaran et al., 2009). However, it is observed that those with extremely extensive experience, more than 4.5 ventures, identify fewer opportunities (Blume & Covin, 2011; Kaplan & Lerner, 2010). This suggests a complexity in the relationship between experience and opportunity identification, indicating that an extremely high level of experience might lead to lower opportunity identification (Alvarez & Barney, 2020). It is possible to observe how dissatisfaction relates to the likelihood of founders leveraging their industry experience. Surprisingly, it is found that higher dissatisfaction is associated with a lower likelihood of leveraging experience (Haynes, 2003). This highlights the importance of considering not only the quantity of experience but also satisfaction and how experience is utilized in the decision-making process.

In a broader context, significant differences have been observed between novice and experienced entrepreneurs across various hypothetical dimensions (Baron, 2009).

This analysis suggests that the two groups differ in crucial aspects, emphasizing the need to consider the unique characteristics of each category when exploring decision-making dynamics (Emami & Dimov, 2017). A clear example of decision-making differences between novice and experienced entrepreneurs can be illustrated with a relatively simple decision, such as naming a company. It has been observed that serial entrepreneurs tend to consider diverse strategies (cognitive and emotional), while novices primarily focus on using a rational strategy. This finding indicates how experience not only influences strategic decisions but also extends to tangential aspects, such as company nomenclature.

## Methodology

Qualitative research, initially focused on in-depth interviews, has evolved into a more advanced methodology known as neuro-qualitative interviews. This innovative approach combines qualitative methods with physiological measurement technologies, specifically Galvanic Skin Response (GSR), to deepen the understanding of the investigated phenomena (Agudelo et al., 2022). In contrast to conventional qualitative interviews, which centre on participants' verbal expression to explore subjective experiences, perceptions, and emotions, neuro-qualitative interviews incorporate GSR technology (Calero et al., 2023). This technology records changes in skin electrical conductance, providing an indicator of emotional and physiological responses (Ohme et al., 2009). Measuring GSR during neuro-qualitative interviews provides additional and objective data about participants' emotional response patterns. These changes in skin conductance are linked to the activation of the autonomic nervous system, reflecting emotional responses such as anxiety, excitement, or stress (Crichtley, 2002).

Juárez introduced the concept of neuro-qualitative interviews (Juarez et al., 2020), emphasizing how neuroscience technologies, such as GSR, can bring new insights to in-depth interviews. This synergy between qualitative methods and advanced technologies enriches the understanding of the studied phenomena. Specific examples of this combination can be found in research (Agudelo et al., 2022), where GSR is used to record emotional excitement during in-depth interviews. Another study in the gastronomic sector employs neuromarketing techniques combined with in-depth interviews to determine the emotional impact of analysed variables compared to the actual taste of foods (Mengual-Recuerda et al., 2020).

These studies demonstrate how the integration of neuro-qualitative methods not only enriches research in areas such as psychology and cognitive neuroscience but also provides a more comprehensive and objective insight into complex phenomena in various fields of study. It is crucial to emphasize that the application of GSR technology in neuro-qualitative interviews requires precise methodological considerations, such as proper preparation and calibration of measurement devices. In summary, neuro-qualitative interviews represent a valuable tool for exploring cognitive and emotional processes, merging qualitative richness with the objectivity of physiological response (Levrini & dos Santos, 2021).

## **Initial hypothesis**

Significant differences in emotional responses during the decision-making process are expected between novice and experienced entrepreneurs. Novice entrepreneurs are anticipated to experience more intense emotional levels in questions related to long-term consolidation or fears of entrepreneurship due to the novelty of business situations. In contrast, experienced entrepreneurs may exhibit more balanced emotions in these questions but more intense emotions in specific topics, such as medium-term hiring or future revenue.

## **Methodological design**

This study was conducted in two stages, addressing two groups of entrepreneurs with different levels of experience. The first stage involved novice entrepreneurs identified in the business ecosystem of Universitat Politècnica de València, called Ideas UPV, who were in the early stages of consolidating their ideas and had not yet established consolidated businesses. The second stage focused on experienced entrepreneurs and was conducted in the startup acceleration program Lanzadera, located in the city of Valencia (Spain), where startups in advanced stages with over 2 years of development were found.

The study aimed to investigate the influence of emotions on decision-making among novice and experienced entrepreneurs. The sample consisted of 40 entrepreneurs, divided into two groups: 20 novice entrepreneurs and 20 experienced entrepreneurs. Galvanic Skin Response (GSR) technology was employed in in-depth interviews to measure participants' emotional responses. During the interviews, factors affecting their emotions in making business decisions were explored. The collected data were analysed for patterns and correlations between emotions and the considered factors. Emotional responses of the two groups were compared to identify possible differences. Confidentiality and informed consent of the participants were ensured.

### **First stage: novice entrepreneurs**

For each participant in this group, an individual in-depth interview was conducted. Initially, the Galvanic Skin Response (GSR) equipment was connected, and a detailed explanation of the purpose and procedure of the interview was provided. Subsequently, in-depth qualitative research interviews were conducted. After answering these questions, the GSR equipment was disconnected. Participants were then asked to mention the question they found most difficult to answer and provide an explanation for their choice, aiming to contrast this information with the GSR results.

### **Second stage: experienced entrepreneurs**

The second stage followed the same procedure as the first but was conducted with experienced entrepreneurs. Through individual in-depth interviews, the same questions were explored, assisted by GSR technology.

## Ethical considerations

Informed consent was obtained from each participant before their participation in the study. Additionally, confidentiality and anonymity of the collected data were ensured.

## Data collection

Specialized equipment was used during this study to conduct in-depth interviews and measure participants' emotional responses.

**GSR:** A Shimmer brand Galvanic Skin Response (GSR) device was employed to measure entrepreneurs' emotional responses during interviews. GSR is a technology that measures variations in skin electrical conductivity in response to emotional and psychological changes. The choice of the Shimmer brand equipment was based on its accuracy and ability to reliably record participants' emotional responses. The software used for recording skin galvanic activity was Consensys v1.6.0 Pro.

**Video Camera:** A digital video camera was used to record verbal and bodily responses provided by participants during in-depth interviews. This recorder allowed capturing detailed responses and explanations provided by entrepreneurs regarding the questions posed in the interview.

Both pieces of equipment were selected with the aim of obtaining accurate and reliable data, both in terms of emotional and verbal responses. The Shimmer brand GSR technology allowed measuring participants' emotional reactions in real-time, while the digital video camera facilitated the comprehensive capture of verbal and bodily responses and explanations, ensuring a thorough understanding of entrepreneurs' perspectives.

## Sample size and participant preparation

The sample size employed in this research comprised a total of 40 individuals, aged between 20 and 35 years, distributed into two distinct groups. The first group consisted of novice entrepreneurs, those who had been running their ventures for less than 5 months, with a gender distribution of 50%, and an average age of 24.5 years. The second group was composed of entrepreneurs with consolidated experience of over 2 years in the entrepreneurial process, with a gender distribution of 50%, and an average age of 28.5 years. Recruitment was voluntary and conducted in two different locations: the first group was interviewed at the Ideas UPV facilities of the Universitat Politècnica de València, while the second group was interviewed at the Lanzadera offices in Valencia.

Participant selection was based on specific criteria of entrepreneurial experience duration, in addition to an equal gender distribution. Participants were invited to join the study and asked for their informed consent to ensure conscious and voluntary participation.



## Results

### In-depth interviews

In order to contrast the results of the in-depth interviews between the two study groups, an analysis of participant responses was conducted by groups, seeking patterns of behavior in their answers to identify commonalities among novice entrepreneurs and among experienced entrepreneurs.

The response patterns identified in novice entrepreneurs are presented in Table 1:

The response patterns identified in experienced entrepreneurs are presented in Table 2:

### Emotional response during the qualitative study: Neuroqualitative

To analyse the biometric results of the galvanic skin response, we averaged the data obtained from each group of participants for each of the questions. In Fig. 1, we can precisely see this average for each of the questions posed.

The questions from 1 to 6 listed in Fig. 1 are as follows:

#### Question 1. What were your biggest fears when starting your venture?

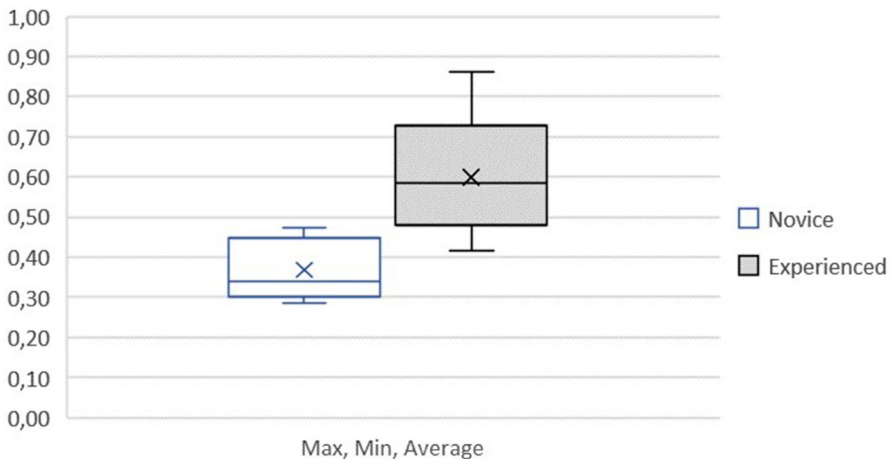
In this question, a marked difference in emotional intensity is observed between experienced and novice entrepreneurs. Experienced entrepreneurs exhibit significantly higher emotional intensity when addressing their own previous failures. Their prior experience allows them to approach the question with a more intense emotional charge, as they reflect on past experiences. On the other hand, novice entrepreneurs respond based on assumptions or current fears in their ventures but have not yet experienced concrete failures. This distinction suggests that emotional intensity in this specific situation is linked to previous experience with failure, highlighting how past experiences affect the emotional perception of the question.

**Table 1** Response patterns identified in novice entrepreneurs

Question	Most repeated responses
What were your biggest fears when starting your venture?	In general, the fear that the idea may not work, that they won't find the right customers, or that they won't assemble the ideal team are the most common fears among novice entrepreneurs.
What factors do you believe are key to a successful venture?	Patience, determination, planning, luck, and a cohesive team.
Do you see your current competition as a threat?	Generally, they do not view their competition as a threat since they are confident in having an original idea that lacks competition, generating a high level of confidence.
Do you have confidence in the long-term consolidation of your venture?	At this point, responses are divided. Some entrepreneurs express 100% confidence that their venture will consolidate, while others are less certain and have doubts about its consolidation.
What are your revenue projections for the next two years?	Regarding income, responses vary significantly, indicating uncertainty and a lack of clear planning on this aspect.
What is your hiring outlook for the next two years?	The majority of novice entrepreneurs do not plan to hire new personnel until their idea has initially consolidated.

**Table 2** Response patterns identified in experienced entrepreneurs

Question	Most repeated responses
What were your biggest fears when starting your venture?	The most common fears among experienced entrepreneurs were the loss of time invested, financial loss, fear of failure, and leaving their previous job before starting their own venture.
What factors do you believe are key to a successful venture?	Key factors mentioned by experienced entrepreneurs for successful entrepreneurship include perseverance, planning, consistency, teamwork, and confidence.
Do you see your current competition as a threat?	Unlike novice entrepreneurs, most experienced entrepreneurs view current competition as a threat. Having been in the market, they are more aware of their real competition and consider it a significant factor.
Do you have confidence in the long-term consolidation of your venture?	All experienced entrepreneurs express unwavering confidence in the long-term consolidation of their ventures, showing no signs of doubt.
What are your revenue projections for the next two years?	Regarding income projections for the next two years, responses vary, but experienced entrepreneurs demonstrate a clear understanding of their numbers, having worked them out on a day-to-day basis.
What is your hiring outlook for the next two years?	In terms of hiring personnel over the next two years, the majority of experienced entrepreneurs have a well-defined plan, whether they need to hire or not.

**Fig. 1** GSR response for question 1: Greatest fears when starting out. Source: prepared by the authors

## Question 2. What factors do you believe are key to successful entrepreneurship?

Despite the emotional intensity between both groups not showing significant differences in this question, there is a noticeable disparity in the magnitude of emotional intensity. Experienced entrepreneurs exhibit significantly higher emotional intensity as they, based on their previous experiences, must recall the most effective strategies that have worked for them. In contrast, novice entrepreneurs share from their current experience and highlight their strengths in this venture. This distinction in emotional intensity suggests that reflecting on past experiences contributes to a greater

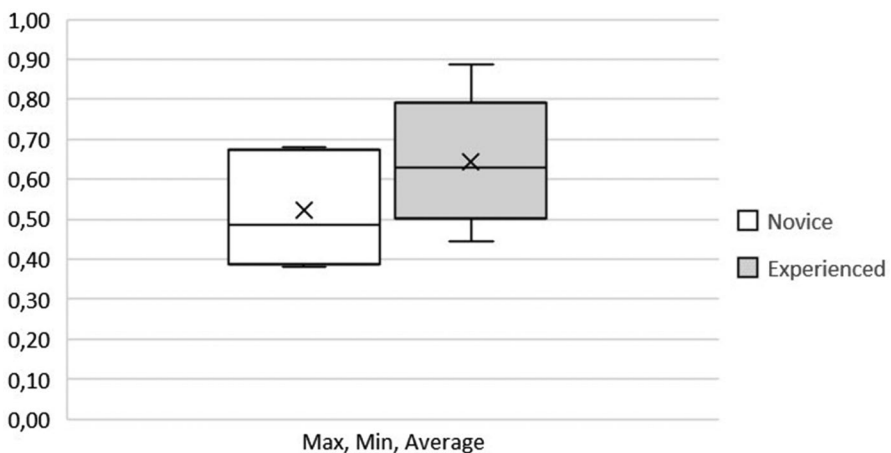
emotional burden in experienced entrepreneurs, while novices approach the question from a more present-focused perspective, emphasizing their current strengths in entrepreneurship (Fig. 2).

### Question 3. Do you consider your current competition as a threat?

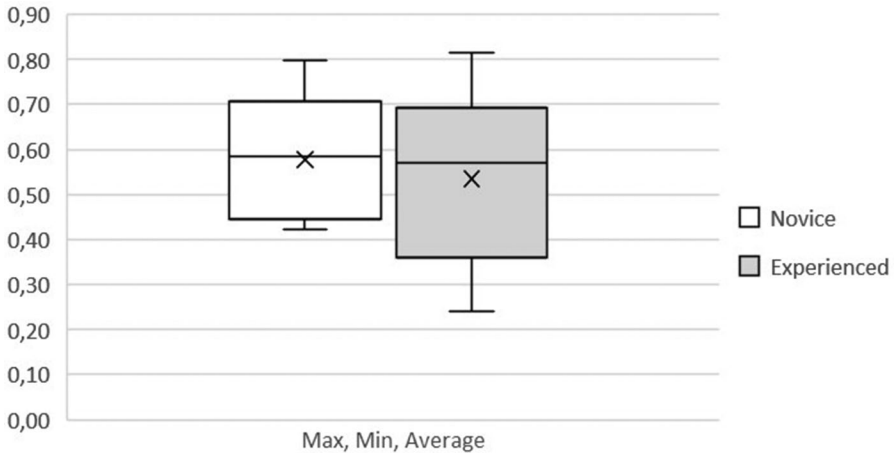
This question stands out as the only one where emotional intensity aligns between the two groups. Upon careful analysis of the responses, it is revealed that novice entrepreneurs express a high level of confidence in the absence of visible competition for their venture. On the other hand, experienced entrepreneurs demonstrate a broader knowledge of their competition, and although their responses differ, the emotional reaction is similar. Both groups exhibit a moderate sense of calm when addressing the topic of competition, highlighting a unique correspondence in emotional intensity in this specific area (Fig. 3).

### Question 4. Do you have confidence in the long-term consolidation of your venture?

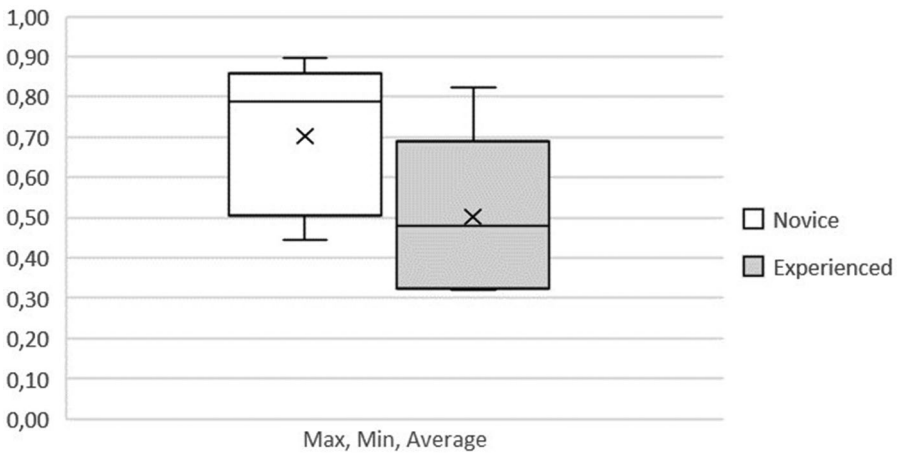
In this question, notable changes in emotional intensity emerge, revealing marked differences between novice and experienced entrepreneurs. In novice entrepreneurs, there is an increase in emotional intensity, aligning with the responses from the interviews. These novice entrepreneurs display higher emotional intensity, reflecting lower confidence in the success of their venture. On the other hand, experienced entrepreneurs respond with calmness, expressing complete confidence in the success of their businesses. This contrast highlights the divergence in emotional perception associated with confidence in business success between the two groups (Fig. 4).



**Fig. 2** GSR response for question 2: Key factors for success in entrepreneurship. Source: Prepared by the authors



**Fig. 3** GSR response for question 3: Consideration of current competition as a threat. Source: Prepared by the authors



**Fig. 4** GSR response for question 4: Confidence in the long-term consolidation of the entrepreneurship. Source: Prepared by the authors

### Question 5. What is your revenue forecast for the next two years?

When we approach the economic perspective with novice entrepreneurs, such as in the case of the revenue projection for the next 2 years, we observe a notable high emotional intensity (0.59–0.95). This suggests that this topic has been explored to a lesser extent by these novice entrepreneurs, or it reflects an optimistic attitude without a thorough analysis of their figures. In contrast, experienced entrepreneurs provide firm responses and clear analysis in their projections, evidenced by mostly low emotional intensity in most cases (0.13–0.69). This underscores the preparation and

depth with which experienced entrepreneurs address future financial considerations compared to their novice counterparts (Fig. 5).

### What is your hiring plan for the next two years?

In this specific analysis, we observe that novice entrepreneurs experience a notable emotional activation (0.68–0.99) when faced with an unexpected question, suggesting that this reaction arises from discomfort in responding to something not previously considered. In contrast, experienced entrepreneurs exhibit significantly lower emotional intensity, with a wide range ranging from very low to intermediate values (0.10–0.68). This reflects the clarity that many of them have regarding their hiring plan, responding in a calm and thoughtful manner, demonstrating greater preparation compared to novice entrepreneurs (Fig. 6).

In Fig. 7, we can observe that the emotional intensity of novice entrepreneurs increases as we approach more specific questions, such as revenue projection and hiring forecast. We can also see a linear increase in emotional intensity, which is often common in these types of studies when there is an emotional connection with the topic being discussed. Additionally, in the second question, there is a higher emotional average than expected in a linear increase, suggesting that the second question might have been somewhat more challenging to answer than the others.

In Fig. 8, we can observe that experienced entrepreneurs exhibit an emotional response contrary to the previous group, but this time with a decreasing linear trend, with a slight increase in question 2, which also showed the same pattern in the previous group. It is evident that, being a group of more experienced entrepreneurs, they felt more confident, and their emotional intensity decreased as the interview progressed.

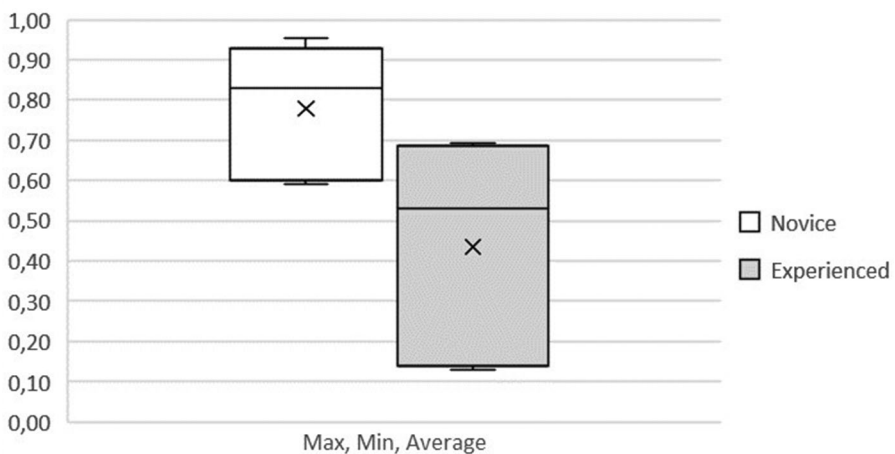
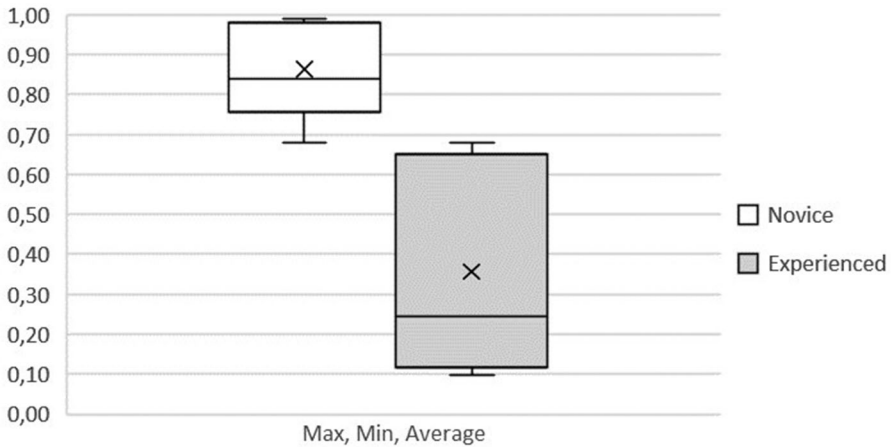


Fig. 5 GSR response for question 5: Two-year revenue forecast. Source: Prepared by the authors



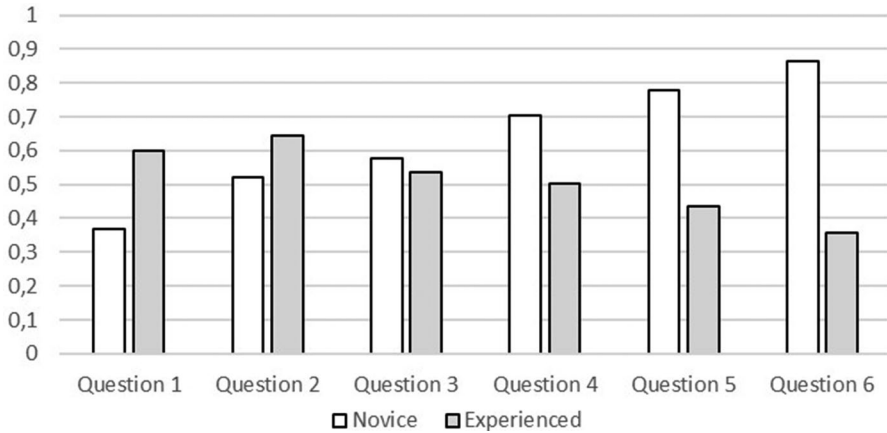
**Fig. 6** GSR response for question 6: Staff hiring forecast for the next two years. Source: Prepared by the authors



**Fig. 7** Emotional intensity (Arousal) novice vs. experienced entrepreneurs. Source: Prepared by the authors

## Discussion and conclusions

Through the application of neuroqualitative approaches, light has been shed on the emotional responses of novice and experienced entrepreneurs in various situations related to business decision-making. The analysis of emotional responses provides valuable insights into how these two categories of entrepreneur's experience and manage their emotions in different phases of their entrepreneurial journey. It has been observed that novice entrepreneurs exhibit a significantly higher emotional intensity when facing questions on topics they have not had the opportunity to reflect on previously. Furthermore, questions revolving around intricate themes such as fears in entrepreneurship, or the long-term viability of their business initiative are approached



**Fig. 8** Emotional intensity (arousal) per question. Source: Prepared by the authors

with greater confidence and clarity in their responses. This pattern could indicate that novice entrepreneurs possess inherent courage and an ability to manage their emotions when venturing into the unknown, as is the case with their emerging businesses.

In contrast, experienced entrepreneurs reveal different emotional responses, showing significant emotional intensity when addressing queries related to the fears of entrepreneurship and crucial factors for business success. These emotional responses may reflect memories of the challenges faced during the early years of their entrepreneurial endeavours. However, when addressing issues such as hiring planning and revenue forecasts, a decrease in emotional intensity is observed, indicating greater calmness and mastery over these aspects. These emotional findings highlight the intricate dynamic between the innate courage of novice entrepreneurs and the insight of experienced entrepreneurs, who have developed a profound understanding of the overall entrepreneurial landscape. Emotional responses, particularly evident in questions like 5 and 6, indicate a decrease in emotional intensity among experienced entrepreneurs, suggesting greater mastery and confidence in these areas.

In summary, the results indicate that novice entrepreneurs tend to focus on innovation and differentiation from competitors, while experienced entrepreneurs maintain a broader perspective and emotional stability when addressing issues related to their own ventures. This research provides a richer understanding of how emotional responses evolve over time and contributes to understanding how entrepreneurs face the challenges and opportunities inherent in decision-making in the business domain.

These conclusions present your findings and insights in a more structured and refined manner, emphasizing how novice and experienced entrepreneurs experience and manage their emotions in different stages of their entrepreneurial journeys.

**Funding** Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this

article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Acharya, K., & Berry, G. R. (2023). Characteristics, traits, and attitudes in entrepreneurial decision-making: Current research and future directions. *International Entrepreneurship and Management Journal*. <https://doi.org/10.1007/s11365-023-00912-y>.
- Agudelo, D., S., et al. (2022). Measuring the impact of packaging in wine, a neuromarketing study. *3c Empresa*, 11(1), 17–43. <https://doi.org/10.17993/3cemp.2022.110149.17-43>.
- Akehurst, G., et al. (2009). Job satisfaction and commitment in the entrepreneurial SME. *Small Business Economics*, 32(3), 277–289. <https://doi.org/10.1007/s11187-008-9116-z>.
- Alvarez, S., & Barney, J. B. (2020). Has the concept of opportunities been fruitful in the field of entrepreneurship? *Academy of Management Perspectives*, 34(3), 300–310. <https://doi.org/10.5465/amp.2018.0014>.
- Amess, K., et al. (2016). The impact of private equity on firms' patenting activity. *European Economic Review*, 86, 147–160. <https://doi.org/10.1016/j.eurocorev.2015.08.013>.
- Autio, E., et al. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1), 72–95. <https://doi.org/10.1002/sej.1266>.
- Bae, T. J., et al. (2014). The relationship between Entrepreneurship Education and Entrepreneurial intentions: A Meta-Analytic Review. *Entrepreneurship Theory and Practice*, 38(2), 217–254. <https://doi.org/10.1111/etap.12095>.
- Bao, S. Q., et al. (2023). What drives the effectual entrepreneurship: Combinative effects of environmental uncertainty and entrepreneurs' means. *Chinese Management Studies*. <https://doi.org/10.1108/cms-04-2022-0147>.
- Baron, R. A. (2009). Effectual versus predictive logics in entrepreneurial decision making: Differences between experts and novices Does experience in starting new ventures change the way entrepreneurs think? Perhaps, but for now, *Caution is essential*. *Journal of Business Venturing*, 24(4), 310–315. <https://doi.org/10.1016/j.jbusvent.2008.04.001>.
- Barrett, L. F., et al. (2007). The experience of emotion. *Annual Review of Psychology*, 58, 373–403. <https://doi.org/10.1146/annurev.psych.58.110405.085709>.
- Basu, S., et al. (2011). Towards understanding who makes corporate venture capital investments and why. *Journal of Business Venturing*, 26(2), 153–171. <https://doi.org/10.1016/j.jbusvent.2009.07.001>.
- Behrens, J., & Patzelt, H. (2016). Corporate entrepreneurship managers' project terminations: Integrating Portfolio-Level, Individual-Level, and firm-level effects. *Entrepreneurship Theory and Practice*, 40(4), 815–842. <https://doi.org/10.1111/etap.12147>.
- Bettinelli, C., et al. (2017). Researching entrepreneurship in Family firms. *Journal of Small Business Management*, 55(4), 506–529. <https://doi.org/10.1111/jsbm.12347>.
- Bierwerth, M., et al. (2015). Corporate entrepreneurship and performance: A meta-analysis. *Small Business Economics*, 45(2), 255–278. <https://doi.org/10.1007/s11187-015-9629-1>.
- Biniari, M. G. (2012). The emotional embeddedness of corporate entrepreneurship: The case of Envy. *Entrepreneurship Theory and Practice*, 36(1), 141–170. <https://doi.org/10.1111/j.1540-6520.2010.00437.x>.
- Blume, B. D., & Covin, J. G. (2011). Attributions to intuition in the venture founding process: Do entrepreneurs actually use intuition or just say that they do? *Journal of Business Venturing*, 26(1), 137–151. <https://doi.org/10.1016/j.jbusvent.2009.04.002>.
- Brundin, E., & Languilaire, J. C. (2023). When the display of emotion is not enough: An emotion boundary management perspective on the quality of strategic decisions\*. *Long Range Planning*, 56(5). <https://doi.org/10.1016/j.lrp.2022.102245>.
- Brundin, E., et al. (2022). Emotion in strategic management: A review and future research agenda. *Long Range Planning*, 55(4). <https://doi.org/10.1016/j.lrp.2021.102144>.
- Calero, J. A. M., et al. (2023). Self-adjustable galvanic skin response sensor for physiological monitoring. *Ieee Sensors Journal*, 23(3), 3005–3019. <https://doi.org/10.1109/jsen.2022.3233439>.



- Camuffo, A., et al. (2020). A Scientific Approach to Entrepreneurial decision making: Evidence from a Randomized Control Trial. *Management Science*, 66(2), 564–586. <https://doi.org/10.1287/mnsc.2018.3249>.
- Cardon, M. S., et al. (2012). Exploring the heart: Entrepreneurial emotion is a hot topic. *Entrepreneurship Theory and Practice*, 36(1), 1–10. <https://doi.org/10.1111/j.1540-6520.2011.00501.x>.
- Cardon, M., et al. (2013). Measuring entrepreneurial passion: Conceptual foundations and scale validation. *Journal of Business Venturing*, 28, 373–396. <https://doi.org/10.1016/j.jbusvent.2012.03.003>.
- Carreon, N. H. (2017). Emotional intelligence in entrepreneurship: a mandatory discussion to generate successful entrepreneurs [Article]. *CPMark - Caderno Profissional de Marketing*, 5, 39+. <https://link.gale.com/apps/doc/A596818286/AONE?u=googleScholar&sid=googleScholar&xid=60235cfb>
- Cegarra-Navarro, J. G., et al. (2023). The role of knowledge and interpersonal competences in the development of civic and public engagement and entrepreneurial intention. *International Entrepreneurship and Management Journal*. <https://doi.org/10.1007/s11365-023-00910-0>.
- Choi, Y. R., & Shepherd, D. (2003). Entrepreneurs' Decisions to Exploit Opportunities. *Journal of Management*, 30. <https://doi.org/10.4337/9781783479801.00010>.
- Critchley, H. D. (2002). Electrodermal responses: What happens in the brain. *The Neuroscientist : A Review Journal Bringing Neurobiology, Neurology and Psychiatry*, 8(2), 132–142. <https://doi.org/10.1177/107385840200800209>.
- Derakhshan, A., et al. (2023). I never make a permanent decision based on a temporary emotion: Unveiling EFL teachers' perspectives about emotions in assessment. *Applied Linguistics Review*. <https://doi.org/10.1515/applirev-2023-0089>.
- Dew, N., et al. (2015). Entrepreneurial expertise and the use of control. *Journal of Business Venturing Insights*, 4, 30–37. <https://doi.org/10.1016/j.jbvi.2015.09.001>.
- Emami, A., & Dimov, D. (2017). Degree of innovation and the entrepreneurs' intention to create value: A comparative study of experienced and novice entrepreneurs. *Eurasian Business Review*, 7(2), 161–182. <https://doi.org/10.1007/s40821-016-0068-y>.
- Engel, Y., et al. (2022). How novice and experienced entrepreneurs name new ventures. *Journal of Small Business Management*, 60(4), 828–858. <https://doi.org/10.1080/00472778.2020.1738820>.
- Foo, M. D. (2011). Emotions and entrepreneurial opportunity evaluation. *Entrepreneurship Theory and Practice*, 35(2), 375–393. <https://doi.org/10.1111/j.1540-6520.2009.00357.x>.
- Gamero, H., & Ostos, J. (2020). Systematic literature review about key factors in the identification of business opportunities. *Retos-Revista De Ciencias De La Administracion Y Economia*, 10(20), 307–327. <https://doi.org/10.17163/ret.n20.2020.07>.
- Grichnik, D., et al. (2010). The importance of being emotional: How do emotions affect entrepreneurial opportunity evaluation and exploitation? *Journal of Economic Behavior & Organization*, 76(1), 15–29. <https://doi.org/10.1016/j.jebo.2010.02.010>.
- Haynes, P. J. (2003). Differences among entrepreneurs. *International Journal of Entrepreneurial Behavior & Research*, 9(3), 111–128. <https://doi.org/10.1108/13552550310476193>.
- Haynie, J. M., et al. (2009). An opportunity for me? The role of resources in opportunity evaluation decisions. *Journal of Management Studies*, 46(3), 337–361. <https://doi.org/10.1111/j.1467-6486.2009.00824.x>.
- Jaime, J., & Benjumea, A. (2022). Determining factors of business consolidation: An integrative approach from the entrepreneur, the company and the environment. *Contaduría Y administración*, 67, 5. <https://doi.org/10.22201/fca.24488410e.2022.2981>.
- Juarez, D., et al. (2020). Neuromarketing Applied to Educational Toy Packaging. *Frontiers in Psychology*, 11, Article2077. <https://doi.org/10.3389/fpsyg.2020.02077>.
- Juárez-Varón, D., et al. (2023). Footwear consumer behavior: The influence of stimuli on emotions and decision making. *Journal of Business Research*, 164, 114016. <https://doi.org/10.1016/j.jbusres.2023.114016>.
- Kaplan, S. N., & Lerner, J. (2010). It ain't broke: The past, Present, and future of Venture Capital. *Journal of Applied Corporate Finance*, 22(2), 36–47. <https://doi.org/10.1111/j.1745-6622.2010.00272.x>.
- Kollmann, T., et al. (2019). I can't get no sleep-the differential impact of entrepreneurial stressors on work-home interference and insomnia among experienced versus novice entrepreneurs. *Journal of Business Venturing*, 34(4), 692–708. <https://doi.org/10.1016/j.jbusvent.2018.08.001>.
- Levrini, G. R. D., & dos Santos, M. J. (2021). The influence of price on Purchase intentions: Comparative study between cognitive, sensory, and neurophysiological experiments. *Behavioral Sciences*, 11(2). <https://doi.org/10.3390/bs11020016>.

- Maresch, D., et al. (2023). Hotspurs in, sober bores out: A call and an agenda for entrepreneurship and innovation policies that foster rapidly scaling ventures. *Technological Forecasting and Social Change*, 196, 122846. <https://doi.org/10.1016/j.techfore.2023.122846>.
- McVea, J. F. (2009). A field study of entrepreneurial decision-making and moral imagination. *Journal of Business Venturing*, 24(5), 491–504. <https://doi.org/10.1016/j.jbusvent.2008.07.003>.
- Mengual-Recuerda, A., et al. (2020). Neuromarketing in Haute Cuisine gastronomic experiences. *Frontiers in Psychology*, 11, Article 1772. <https://doi.org/10.3389/fpsyg.2020.01772>.
- Ohme, R., et al. (2009). Analysis of neurophysiological reactions to Advertising Stimuli by means of EEG and galvanic skin response measures. *Journal of Neuroscience Psychology and Economics*, 2, 21–31. <https://doi.org/10.1037/a0015462>.
- Podoyntsyna, K., et al. (2012). The role of mixed emotions in the risk perception of novice and serial entrepreneurs. *Entrepreneurship Theory and Practice*, 36(1), 115–140. <https://doi.org/10.1111/j.1540-6520.2011.00476.x>.
- Shepherd, D. A., et al. (2011). Moving forward from project failure: Negative emotions, affective commitment, and learning from the experience. *Academy of Management Journal*, 54(6), 1229–1259. <https://doi.org/10.5465/amj.2010.0102>.
- Ucbasaran, D., et al. (2009). The extent and nature of opportunity identification by experienced entrepreneurs. *Journal of Business Venturing*, 24(2), 99–115. <https://doi.org/10.1016/j.jbusvent.2008.01.008>.
- VanElzakker, M. B., et al. (2014). From Pavlov to PTSD: The extinction of conditioned fear in rodents, humans, and anxiety disorders. *Neurobiology of Learning and Memory*, 113, 3–18. <https://doi.org/10.1016/j.nlm.2013.11.014>.
- Welpe, I. M., et al. (2012). Emotions and opportunities: The interplay of opportunity evaluation, fear, Joy, and anger as antecedent of Entrepreneurial Exploitation. *Entrepreneurship Theory and Practice*, 36(1), 69–96. <https://doi.org/10.1111/j.1540-6520.2011.00481.x>.
- Zollo, L., et al. (2021). Entrepreneurial passion, orientation and behavior: The moderating role of linear and nonlinear thinking styles. *Management Decision*, 59(5), 973–994. <https://doi.org/10.1108/md-10-2019-1500>.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## Authors and Affiliations

Juan Camilo Serna-Zuluaga<sup>1</sup>  · David Juárez-Varón<sup>1</sup>  ·  
Ana Mengual-Recuerda<sup>1</sup>  · Ana Medina-López<sup>2</sup> 

✉ David Juárez-Varón  
djuarez@upv.es

Juan Camilo Serna-Zuluaga  
jcszeru2@upv.es

Ana Mengual-Recuerda  
anmenre1@upv.es

Ana Medina-López  
ana.medina@urjc.es

<sup>1</sup> Universitat Politècnica de València, Valencia, Spain

<sup>2</sup> Universidad Rey Juan Carlos, Madrid, Spain