


# How to measure knowing without knowing? A systematic bibliometric mapping and visualization of relationships between the psychometric properties of rational and intuitive decision-making styles

**Working Paper****Author(s):**

Fellnhofer, Katharina 

**Publication date:**

2022

**Permanent link:**

<https://doi.org/10.3929/ethz-b-000590183>

**Rights / license:**

[Creative Commons Attribution 4.0 International](#)

**Funding acknowledgement:**

882168 - An intuitive entrepreneurial gender ceiling and its impact on entrepreneurial success and access to finance (EC)

# How to Measure and Enhance Knowing Without Knowing? A Systematic Bibliometric Mapping and Visualization of Relationships between Rational and Intuitive Decision-Making Styles To Explore Training Methods

Katharina Fellnhofer<sup>1,2\*</sup>

<sup>1</sup> Swiss Federal Institute of Technology Zuerich, ETH Zuerich, Chair of Education Systems, Department of Management, Technology and Economics, Switzerland

<sup>2</sup> Harvard University, Department of Sociology, USA

\*Corresponding author: [kfellnhofer@ethz.ch](mailto:kfellnhofer@ethz.ch)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 882168.

**Abstract.** In this work, we investigate rational and intuitive decision-making styles via a literature review by taking advantage of advanced bibliometric analysis techniques. The aim of this mapping and clustering analysis is to systematically explore organizational research dedicated to cognitive styles to discover how the phenomenon of intuition shapes and is shaped by individuals in organizational contexts. This work aims to inspire future research, in particular for measuring intuitive decision making – that is, the unconscious form – with a particular focus on the organizational framework. The data examined from the Web of Science and Scopus databases comprise 20,582 peer reviewed documents published through the end of 2019. Based on this research review of decision-making styles across research domains and entrepreneurship literature in particular, this first systematic bibliometric mapping and visualization study offers insights and inspiration on how to measure and enhance intuition with a particular focus on the unconscious mind to investigate knowing without knowing with new approaches in the context of organizations.

**Keywords:** Rational decision making; intuitive decision making; unconscious; systematic bibliometric mapping; bibliometric visualization

## **Introduction**

Recent years have seen notable advances that culminated in a comprehensive understanding of decision-making styles (Wang, Highhouse, Lake, Petersen, & Rada, 2017). Intuition and rationality represent the two baselines of cognitive processing theories (Epstein, Pacini, Denes-Raj, & Heier, 1996; Stanovich & West, 2000b). Based on Epstein et al.'s (1996) cognitive-experiential self-theory, a dual process theory of personality, individuals manage knowledge in two analogous, cooperating, simultaneous, and mutually influential systems (Sinclair, 2011). Dual process theories build on the notion that we make decisions based on two complementary but dissimilar processes: System 1, an intuitive-experiential approach that is automatic, reflexive, and effortless, and System 2, an analytical-rational thinking style that is intentional, reflective, and effortful. These systems have been extensively discussed in the academic discourse (e.g., Jung, Baynes, & Beebe, 2016; Kahneman & Frederick, 2012; Wang et al., 2017). We know that System 2 does not guarantee rational decision making and that System 1 does not automatically produce irrational decisions (Grayot, 2020; Leach & Weick, 2018). Research has shown that intuition complements rationality in an effective decision-making approach (Carter, Kaufmann, & Wagner, 2017), which can create paradoxical tensions that may be fruitful in the organizational context (Calabretta, Gemser, & Wijnberg, 2017). Measuring how the two approaches unfold while taking consciousness and unconsciousness into account represents a global scientific challenge with far-reaching impact across disciplines (Aczel, Lukacs, Komlos, & Aitken, 2011), particularly as it is a crucial source for expertise in the real-world context of any organization (Dreyfus & Dreyfus, 2005).

There are three meta-analyses related to the difference between decision-making styles. The first, with a sample of 17,704 participants, was undertaken by Phillips, Fletcher, Marks, & Hine (2016). Intuition was negatively correlated with performance depending on the framework of the specific decision task but positively correlated with experiences such as speed and enjoyment.

Wang et al. (2017) published two additional meta-analyses ( $N = 27,501$ ) concluding that intuition and deliberation can be viewed as independent constructs. The third meta-analysis (Wang et al., 2017) found also a near-zero correlation between intuition and rational analysis ( $N = 511$ ). These meta-analyses highlight the crucial nature of embracing a balance between the two decision-making styles when organizations consider strategic courses of action, as scholars have discussed for decades (Calabretta et al., 2017; Schwenk, 1984; Smith, 2014).

There is a broad consensus that decision-making styles and their performance depend significantly on the environment in which a given decision is taken (Phillips et al., 2016). This vibrant environment is shaped by societies, cultures, and organizations. While some argue that deliberation provides better outcomes in specific environments related to confidence (e.g., Koriat, Lichtenstein, & Fischhoff, 1980), others argue that in complex situations intuition obtains better results (Gigerenzer, 2007). For instance, in entrepreneurial adventures intuition is more effective and efficient than the conscious mind (Aczel et al., 2011). Furthermore, entrepreneurs tend to trust intuition more than the analytical mind (Huang and Pearce, 2015). As our organizational world becomes more complex, shaken by crises, and characterized by uncertainty, time pressure, ambiguity, and instability, balancing intuition and analytics is of ever-growing importance (Akinci & Sadler-Smith, 2019; Calabretta et al., 2017; Harteis & Gruber, 2008; Sadler-Smith, 2016; Sinclair & Ashkanasy, 2005; Tissington & Flin, 2005). In such situations, experts use their prior experience to categorize situations quickly (Sinclair, 2011). Intuition is also viewed as a cognitive shortcut to enable entrepreneurs to make improved choices (Busenitz & Barney, 1997; Manimala, 1992; Shepherd, Williams, & Patzelt, 2015).

Intuitions have been depicted as quasi-miraculous occurrences of understanding something without realizing how (Epstein, 2010). Successful decision making based on intuition has received significant attention across research domains. For instance, in the health sector, greater use of

intuition has been correlated with higher clinical competence (Benner & Tanner, 1987; Tilden & Tilden, 1985). Overall, studies emphasize the importance of gaining intuitive experience and expertise across domains (e.g., Dane & Pratt, 2012; Eubanks, Murphy, & Mumford, 2010; Hoffrage & Marewski, 2015; Iannello, Colombo, Germagnoli, & Antonietti, 2020; Kahneman & Klein, 2009; Lufityanto, Donkin, & Pearson, 2016; Myers, 2007; Raio, Carmel, Carrasco, & Phelps, 2012; Salas, Rosen, & Diaz-Granados, 2010; Mikels, Maglio, Reed, & Kaplowitz, 2011): security (e.g., Klein, Calderwood, & Clinton-Cirocco, 2010; Okoli, Watt, Weller, & Wong, 2016; Tissington & Flin, 2005), health (e.g., Gobet & Chassy, 2008; Quirk, 2006; Ruth-Sahd & Hendy, 2005), and management (e.g., Bierly & Gallagher, 2007; Brody & Trad, 1997; Hogarth, 2002; Sadler-Smith & Shefy, 2004; Simon, 1987). Although Lufityanto et al. (2016) provide evidence that nonconscious information can boost decision accuracy, increase self-confidence, and speed up answer times, in line with previous studies (e.g., Mikels et al., 2011), it remains unclear how this unfolds in the organizational context.

While scientific evidence for the existence of intuition in the organizational context is scant, its training methods are even rarer. Prior studies are characterised by a limited methodological focus on survey-based techniques and interviews (Pretz et al., 2014). Self-reporting techniques capture participants' perceptions of intuition rather than their actual ability to make use of nonconscious information to make decisions (Lufityanto et al., 2016). Furthermore, as they do not focus on organizational contexts, it remains unclear how intuition unfolds in organizations. Moreover, the measurements and scales employed use pre and post assessments or involve laboratory experiments that do not reflect the complexity of real environments within an organization, with their multiple complex variables such as complicated organizational contexts, cross-cultural effects, and societal power. Thus far, analysis of how decision makers in organizational settings such as entrepreneurial frameworks use their intuition lacks an operationalization of the intuition construct (Carter et al.,

2017). Therefore, our knowledge about the real effect of intuition on real-world success is limited. There remains a scarcity of data to verify entrepreneurial intuition, which by default is supposed to be more effective than the analytical approach due to environmental complexity. Thus, our review reflects how we can undertake a deeper analysis of measurements and evidence in this context to provide fresh insights how to potentially enhance it in a deliberately way.

Scholars have not yet had access to an interdisciplinary systematic bibliometric mapping that is dedicated to different cognitive thinking styles and incorporates clustering methods. Specifically, bibliometric mapping using clustering techniques that present scientific knowledge visually to shape and interpret investigation clusters. Only a few entrepreneurial studies use bibliographic mapping (e.g., Fellnhofer, 2019; Phan Tan, 2021). Thus, our work offers a richer understanding of intuitive decision making, and our accompanying review provides material for future research into decision-making styles from a holistic perspective that is particularly valuable for the organizational context. Using normative assessments of different cognitive decision-making styles, this review aims to enrich Shepherd et al.'s (2015) insights into what we know about how entrepreneurs make decisions that helps answer Miller's (2007) call for new empirical approaches. We explore current measurements from other disciplines to provide ideas to bridge science and practice and make organizations more aware of such comprehensions (e.g., Banks et al., 2016), with a particular focus on building a natural bridge and balance for paradoxical thinking in organizations that can enrich future strategic pathways (Calabretta et al., 2017). Thus, this systematic mapping study delivers an outline of clusters regarding cognitive decision-making styles by systematically discovering and visually organizing the full range of existing research through both co-citation investigations and bibliometric coupling methods to visualize influential relationships and gaps and recommend future research, especially investigations that focus on how to measure intuition from an organizational perspective using new ideas from different disciplines.

The work is organized as follows. The next section elaborates the theoretical framework, after which the methodological approach is discussed. After presenting the results, we critically reflect on and discuss the results before addressing implications for future research and acknowledging limitations.

## **Theoretical Framework**

### *The cognitive-experiential self-theory for an organization of thought approach*

We follow the processual approach, enriching existing theories related to intuition by thinking not about organizations directly but rather an ‘organization of thought’ approach (Chai, 1996; Nayak, 2008). This approach uses intuition to reveal realities in organizations by embracing the dual process model of cognition (Epstein, 1994; Epstein et al., 1996) as a fundamental step in enriching organizational theories with actors’ intuitive and analytical mind at the centre. This model is at the heart of the cognitive-experiential self-theory and holds that human behaviour is dominated by two separate information processing systems: experiential and rational. While the former is preconscious, automatic, and entwined with intuition and affect, the latter is conscious, controlled, logic-based, and largely free of affect. There are two approaches within the experiential system: naturalistic decision making that concentrates on expert intuition, and the heuristic and biases approach that encourages adopting an unconvinced attitude toward expert judgment. The naturalistic decision-making community is generally made up of practitioners, including those in organizations, who use techniques like cognitive task analysis and field observation to focus on questions of real-world judgments and decision making. By contrast, the heuristic and biases approach focuses on intuitive judgments based on simplifying heuristics that are not as precise and are more prone to systematic biases (Kahneman & Klein, 2009).

The cognitive-experiential self-theory model shares features with the System 1 and 2 model proposed by Stanovich and West (2000a). While intuitive decisions are made by dual-cognitive System 1 operations in an automatic, unintentional, and effortless way, deliberate decisions are controlled, voluntary, and effortful in System 2. For instance, we need System 2 to perform calculations within the organizational context or simply to read maps (Kahneman & Klein, 2009). The System 1 and 2 approach proposes that intuitive processing using System 1 is automatic and must be consciously ignored by the rational System 2. The rational system is intentional, analytic, primarily verbal, and relatively free of affect; it operates primarily at the conscious level. The experiential system is automatic, preconscious, holistic, associative, primarily nonverbal, and intimately associated with affect (Epstein et al., 1996). Stanovich and West (2000a) claim that the impact of the intuitive System 1 is minimized for individuals with higher cognitive capacity. The literature reveals a common distinction as to decision making between System 1 (fast, automatic, associative, heuristic, and intuitive) and System 2 (rule-based, analytical, and reflective; Wang et al., 2017), and its paradoxical but positive impact in the organizational context was introduced by Calabretta et al. (2017).

#### *The role of different cognitive styles in the organizational context*

Calabretta et al. (2017) concluded that organizational leaders need to prepare the ground for paradoxical thinking by accepting the contradictory elements of rational and intuitive decision making. This requires a neutral balance between intuitive and rational practices to be embedded in the organization's culture and processes in a sustainable way and is true for both small and large international organizations, as the dual process difference between rationality and intuition is valid cross-culturally (Witteman, Van Bercken, Claes, & Godoy, 2009). In the organizational context a paradoxical framework for the intuition–rationality tension is formed by accepting and embracing the simultaneous existence of those contradictory forces (Smith & Tushman, 2005). Intuitive and



rational approaches in decision making are combined in the organization. For instance, intangible values such as brands are merged with tangible sales expectations, which shapes the management of financial and nonfinancial objectives that appear to be paradoxical but can positively contribute to each other (Calabretta, Gemser, & Wijnberg 2017a). With this in mind, we build our review on the following definitions of decision-making styles (Epstein, 1991; Epstein et al., 1996; Jung et al., 2016):

*Rational decision-making style* comprises a logical evaluation of alternatives.

*Intuitive decision-making style* depends on feelings and hunches.

*Analytical thinking style* describes a preference for analysing information consciously and intentionally.

*Experiential thinking style* describes a preference to think preconsciously, automatically, and holistically.

*Preference for deliberation* defines relatively slowly elaborated and cognition-based decisions.

*Preference for intuition* defines comparatively fast and even spontaneous decisions.

*Linear thinking style* relies on an analytical method by breaking information into parts and assuming unidimensional and linear relationships between variables.

*Nonlinear thinking style* relies on a holistic method to link parts together and assumes nonlinear and multidimensional relationships.

## **Methodology**

### *A systematic mapping study*

This study uses bibliographic coupling and co-citation mapping. The term *bibliometric* refers to analysing bibliographic information by the use of statistical measurements and quantitative methods (Braun, 2005; van Leeuwen, 2004). By grouping more than 90% of the scientific body

(Boyack & Klavans, 2010), direct (co-)citation analyses and bibliographic coupling are a highly accurate and effective path to map the research literature dedicated to cognitive decision-making styles. As a bibliometric technique, co-citation analysis stresses high reliability by intellectually mapping connections that indicate the “distances” between works (White & Griffith, 1981). In particular, co-citation grids recognize “invisible colleagues” (Gmür, 2003). In a co-citation systematic mapping study, paired or co-cited research documents are weighed and statistically scaled (Osareh, 1996; Pilkington & Teichert, 2006).

Bibliographic coupling using the VOSviewer text analysis software tool is used for presenting vast bibliometric maps of multidimensional scaling (van Eck & Waltman, 2009). Its modularity-based clustering algorithm is a weighted and parameterized mapping technique (Waltman, van Eck, & Noyons, 2010). Robustly linked publications show closely interrelated schools of thought and are positioned closed to one another on the map. Van Eck et al. (2009) stress that VOSviewer maps deliver more informative illustrations of data than diagrams created with other established methods. The algorithm applied has already generated consistent and acceptable outcomes (van Eck & Waltman, 2009, 2010, 2014). The greater degree to which identical references are quoted in articles, the stronger the bibliographic link between these articles will be (e.g., Boyack & Klavans, 2010; Zhao & Strotmann, 2008).

#### *Primary data and data processing*

This bibliographic mapping and visualization analysis followed these steps to identify relevant studies for future ideas regarding innovative methodological approaches.

#### Step 1: Review of decision-making styles across research domains to identify key thinkers

1. *Identification of peer reviewed publications.* We collected all publications in the primary database Web of Science (WoS) including (rational decision-making) or (intuitive decision-making) or (analytical thinking) or (experimental thinking) or (linear thinking) or (nonlinear

thinking) or (gut feeling) or (intuition) or (deliberation) in the document. A total of 20,582 peer reviewed documents were discovered through the end of 2019. Those papers contain 428,343 references.

2. *Quality checks.* Next, the dataset was double-checked against Scopus,<sup>1</sup> EBSCO, and ScienceDirect to identify missing papers. Furthermore, we eliminated papers that used the word “intuition” only to formulate their assumptions. For instance, the word “intuition” is often used in an introductory phrase (e.g. “A common intuition is,” “Counter to intuition”; e.g., Reimer, Wegewijs, Nestmann, & Pletyukhov, 2019). We also searched frequent synonyms for “intuition,” such as “gut feelings,” “hunches,” and “my heart.” Finally, the word “intuition” is also often used in philosophy, where it has a different and specialized meaning (Andow, 2015).
3. *Map creation and cluster identification.* VOSviewer classified the documents into five clusters; 42 references met the threshold of 100 as the minimum number of citations for a reference, out of 428,343 references from 20,582 documents. Thus, 42 authors represent the driving thinkers in cognitive decision-making styles across research domains.
4. *Cluster interpretation.* The papers in each cluster were assessed using the VOSviewer tool for similarities to identify the focus of that cluster.

Step 2: Review of decision-making styles in a specific organizational context: The entrepreneurship literature

5. *Identification of key peer reviewed publications regarding decision-making styles used in the entrepreneurship literature.* We collected all publications in WoS that included the phrases (rational decision-making) or (intuitive decision-making) or (analytical thinking) or

---

<sup>1</sup> (TITLE-ABS-KEY (intuition) OR TITLE-ABS-KEY (gut AND feeling)) AND (TITLE-ABS-KEY (measure\*) OR TITLE-ABS-KEY (assess\*) OR TITLE-ABS-KEY (quantify)).

(experimental thinking) or (linear thinking) or (nonlinear thinking) or (gut feeling) or (intuition) or (deliberation) and (entre\*).^2 In total, 541 peer reviewed documents were defined as relevant after we read each paper's abstract to ensure that we selected only articles that were indeed relevant to decision-making styles. Using CitNetExplorer, a software tool for visualizing and analysing citation networks, we used an algorithmic, historiographic approach to examine the development of this research field in entrepreneurship by finding the most important publications over time.

6. *Cluster identification and interpretation.* Again using CitNetExplorer, we identified five clusters; five was set as the minimum cluster size, meaning that small clusters were merged. As to optimization parameters, the random starting value is one, ten is the number for iterations, and one was chosen as the random seed. Finally, we identified the 35 most important publications for the different decision-making styles over time.
7. *Textual analysis of titles and abstracts.* Using VOSviewer, a textual analysis of the titles and abstracts was performed to identify trends when analysing the entrepreneurship literature on decision-making styles. Eliminating common words<sup>3</sup> enabled us to discuss streams.

### Step 3: Review of measuring intuition across research domains

8. *Identification of peer reviewed publications for measuring intuition via new interdisciplinary approaches.* In this step, we collected all publications in WoS covering the words (intuition) or (gut feeling) or (intuition) or (gut feeling) and (measure) or (assess) in either topic or title.<sup>4</sup>

---

<sup>2</sup> ((ALL=(Rational decision-making) OR ALL=(Intuitive decision-making) OR ALL=(Analytical thinking) OR ALL=(Experimental thinking) OR ALL=(Linear thinking) OR ALL=(Nonlinear thinking) OR ALL=(gut feeling) OR ALL=(intuition) OR ALL=(deliberation)) AND ALL=(Entre\*)).

<sup>3</sup> The following words were excluded: age, antecedent, area, assessment, chapter, collaboration, conception, conceptual framework, consequence, consideration, construction, contribution, control, course, discipline, entrepreneur, entrepreneurship, future research, gap, goal, group, hypothesis, i.e., implementation, importance, improvement, increase, interpretation, kind, knowledge, lack, level, limitation, literature review, methodology, notion, paper, practical implication, research limitations implication, student, study, theoretical framework, today, university, word, and year.

<sup>4</sup> ((TI=(intuition) OR TS=(intuition) OR TI=(gut feeling) OR TS=(gut feeling)) AND (TI=(measure\*) OR TS=(measure) OR TI=(assess\*) OR TS=(assess\*) OR TI=(quantify) OR TS=(quantify))) AND DOCUMENT TYPES: (Article).

In total, 241 peer reviewed documents through the end of 2019 were defined as relevant after we read each paper's abstract to ensure that articles were germane to measuring intuition.

9. *Categorization of measurements based on approach.* The publications were categorized into measurements based on Buckley, Buckley, and Chiang (1976), and we applied the usual standards for classifying literature reviews (Atkinson and Shaffir, 1998; Buckley et al., 1976). Figure 1 illustrates the methodological approach.

-----  
Insert Figure 1 here  
-----

## **Bibliometric Analyses and Results**

### *Bibliographic map of decision-making styles across research domains*

Using bibliographic mapping and clustering, Figure 2 illustrates the 2,728 most frequently cited sources in the research literature published between 1977 and 2019. It presents the five central clusters, based on citation scores across different disciplines, of the literature review which discuss different cognitive styles, such as (rational decision-making) or (intuitive decision-making) or (analytical thinking) or (experimental thinking) or (linear thinking) or (nonlinear thinking) or (gut feeling) or (intuition) or (deliberation).

-----  
Insert Figure 2 here  
-----

Using WoS data, Table 1 lists the 42 most frequent cited references, based on co-citation.

-----  
Insert Table 1 here  
-----

Figure 3 presents the five research clusters; 42 references met the minimum threshold of 100 citations of a given reference, out of 428,343 references from 20,582 documents.

-----  
Insert Figure 3 here  
-----

*Cluster 1* is characterized by individual differences, intuition versus analysis, and dual processes. For instance, individual variations in rational reasoning have been analysed (Stanovich and West, 2000a, 200b). Sloman (1996) and Epstein et al. (1996) discussed individual preferences for intuitive relative to analytical information processes. Pacini and Epstein's (1999) investigated their relationship. Awareness (Evans & Stanovich, 2013) and social cognition (Evans, 2008) provide insights into intuition versus analysis. Kahneman laid the foundation through his *Thinking, Fast and Slow* (2012), his perspective on judgment and choice (2003), and his attribution of change in intuitive decisions (Kahneman & Frederick, 2012). Epstein (1994) discussed the combination of the intellectual and psychodynamic unconscious. This cluster highlights the role and impact of individuals' mindsets within organizations, especially how attitudes such as belief in intuition (e.g., Evans, 2003) can shape decisions, which is crucial for decision makers in leading positions.

*Cluster 2* is characterized by documents related to emotional and moral judgements, fairness, feeling, and brain research. For instance, Rawls (1971) provided a theory of justice, and Damasio (1994) stressed Descartes's error in relation to emotion, reason, and the human brain. According to Nisbett and Wilson (1977), verbal reports on mental processes inform us more than we typically realize. Furthermore, moral psychology has received enormous attention via new synthesis (Haidt, 2007), a map (Graham et al., 2011), a functional magnetic resonance imaging investigation of emotions in moral judgments (Greene, Sommerville, Nystrom, Darley, & Cohen, 2001), cognitive

conflict and control in moral choices (Greene, Nystrom, Engell, Darley, & Cohen, 2004), and different sets of moral decisions (Graham et al., 2009). Cushman, Young, & Hauser (2006) discussed the role of conscious rationality and intuition in moral decisions. Additionally, how intuitions intrinsically generate cultural merits has been examined (Haidt & Joseph, 2004). This cluster emphasizes how ethics and culturally variable virtues (Haidt & Joseph, 2004) are of growing importance to decision-making processes in the organizational context, which can be especially crucial for international businesses.

*Cluster 3* is dedicated to conditions for intuitive decision making as a skill and implicit learning approach, social intuition, and diseases. For instance, the roles of emotion and intuition when making management decisions have been explored (Simon, 1987). In a similar vein, an intuitive executive has been proposed to understand and apply gut feelings when making decisions (Sadler-Smith & Shefy, 2004). Dane and Pratt (2007) explored intuition and its role in organizational decisions, which also relates to the role of intuition in strategic decision making (Khatri & Ng, 2000). Intuition has been also studied using a social cognitive neuroscience approach (Lieberman, 2000), and Kahneman and Klein (2009) discussed the conditions for intuitive expertise. Intuition has been explored in the context of discovery (Bowers et al., 1990) and how it can be taught (Hogarth, 2002). With respect to organizational research, this cluster focuses on intuitive decisions of executives (Sadler-Smith & Shefy, 2004), taking strategic decision making for organizations (Khatri & Ng, 2000) and innovation-driven activities within organizations into particular account (Bowers et al., 1990).

*Cluster 4* focuses on epistemic intuition and cognition; it tends to be driven by theory. For instance, Cappelen (2012) and Williamson (2008) studied philosophical facets. Fundamental work regarding normativity and epistemological intuitions (Weinberg, Nichols, & Stich, 2001), semantics, cross-cultural style (Machery, Mallon, Nichols, & Stich, 2004), naming and necessity

(Kripke, 1981), and the cognitive science of folk intuitions (Nichols & Knobe, 2007) also enriched this research cluster. The cross-cultural aspect and the differences it both does and does not cause in terms of intuition are crucial for dynamic international organizations.

Finally, *Cluster 5* involves articles involving frugal heuristics and their environment. For instance, fuzzy sets have been discussed (Zadeh, 1965). Tversky and Kahneman (1981) studied the framing of decisions and the mindset of choice, heuristics, and biases during judgment under ambiguity (Tversky & Kahneman, 1974) and later provided the fundamental prospect theory regarding assessment of decision under risk (Tversky & Kahneman, 1974). Gigerenzer and Goldstein (1999) offered effortless heuristics. This cluster centres on how intuition is unfolded in uncertainty and risk. As our organizational world becomes more complex, shaken by crises, and characterized by uncertainty, time pressure, ambiguity, and instability, this is particularly important for organizational decision makers facing those situations.

#### *Different cognitive styles in the entrepreneurship literature*

Figure 4 illustrates how work dedicated to cognitive styles evolves in the entrepreneurship literature. For instance, a small cluster is formed by the work of Eling Griffin, & Langerak (2014) on using intuition in fuzzy front-end decision making and the performance of merging rationality and intuition in making evaluation decisions (Eling, Langerak, & Griffin, 2015). Evaluation is a driving topic in organizations. A singular cluster is shaped by Peredo and McLean (2006), who undertook a critical review of social entrepreneurship. Another small cluster is formed by McKelvie, Haynie, & Gustavsson (2011), who illuminated the uncertainty construct with its implications for entrepreneurial activities, and Groves, Vance, & Choi (2011), who examined entrepreneurial cognition based on (non)linear thinking and its relation to success.

A comparatively strong cluster is formed by McCarthy, Schoorman, & Cooper (1993) on investment decisions by entrepreneurs and Carter, Gartner, & Reynolds (1996) on studying start-



up experience. Those two publications are in the same cluster as work by Zacharakis and colleagues, who focused on venture capitalists' decision making, such as the nature of their information source and overconfidence (Zacharakis & Shepherd, 2001, 2005) and whether they understand their decisions (Zacharakis & Meyer, 1998). This literature stream highlights the dominant role intuition can play in financial decision making in organizations that are rational at heart. Later, Bryant (2007) studied self-regulation and heuristics in entrepreneurial opportunity evaluation and exploitation, which was followed by Trevelyan's (2008) focus on optimism, overconfidence, and entrepreneurial activity. Haynie, Shepherd, & McMullen (2009) discussed the role of resources in opportunity evaluation decisions, and Grégoire, Shepherd, & Lambert (2010) examined opportunity recognition principles. This research stream emphasizes that especially during the uncertain beginnings of an organizational context, intuition plays an important role. In those early stages, according to Mitteness, Sudek, & Cardon (2012), specific angel investor traits affect whether perceived passion leads to superior assessments of funding potential. Gielnik, Frese, Graf, & Kampschulte (2012) studied creativity in the opportunity identification process and the moderating effect of diversity of information. "In user's shoes" by Prandelli, Pasquini, & Verona (2016) concerns an experimental design on the role of perspective taking in discovering entrepreneurial opportunities. While Huang (2018) focused on the role of investor gut feel in managing complexity and extreme risk, Huang and Pearce (2015) explained how to control uncertainty via the efficacy of early-stage investor gut feel in entrepreneurial investment decisions. This stream embraces the many positive effects of higher intuition such as tackling uncertainty (e.g., Waroquier et al., 2010; Johnson & Raab, 2003), ambiguity (e.g., Klein, 2008; Wally & Baum, 1994), complexity (e.g., Hodgkinson & Sadler-Smith, 2018; Mesterman, 1967; Nutt, 1999), promoting creativity (e.g., Hodgkinson, Sadler-Smith, Burke, Claxton, & Sparrow, 2009; Sinclair, 2020a, 2020b), opportunity identification (e.g., Burmeister & Schade, 2007; Huang, 2018; Kanze,

Huang, Conley, & Higgins, 2018), and better forecasting (e.g., Blume & Covin, 2011; Eling et al., 2014; Groves et al., 2011).

-----  
Insert Figure 4 here  
-----

### *Measuring intuitive decision making*

Although intuition has received regular attention in recent years, the testability of a mechanism concerning fast and unconscious activities has faced limitations in previous contributions, such as post surveys and interviews (Sinclair, Ashkanasy, & Chattopadhyay, 2010). Table 2 summarizes the different measurement techniques.

-----  
Insert Table 2 here  
-----

Overall, the nature of intuition and how to measure its differences between individuals have generally been measured by commonly used questionnaires of constructs (Pretz & Totz, 2007). Wang et al.'s (2017) meta-analysis focuses on the well-established and most frequently used scales to measure decision-making styles. Examples include Betsch's (2004) preference for intuition and deliberation scale, Van den Broeck, Vanderheyden, & Cools' (2003) cognitive style indicator, Epstein et al.'s (1996), and Pacini and Epstein's (1999) various rational–experiential inventories. Groves, Vance, & Paik (2008) provide a linear–nonlinear thinking style profile. The Myers-Briggs Type Indicator (Myers & McCaulley, 1985) is used across different disciplines (Mitchell & Shuff, 1995). The AIM Survey assesses the relationship between managers' intuition and their performance (Glaser, 1995); finally, there is Mayring's qualitative content analysis (Fröhlich et al.,

2019). Other researchers designed the Free-Will Intuitions Scale to empirically measure folk intuitions in free will debates (Deery, Davis, & Carey, 2015).

The Cognitive Reflection Test (CRT, Frederick, 2005) is also a well-known tool for measuring intuitive–analytic cognitive styles. The CRT is a three-item, performance-based scale (Zhang, Highhouse, & Rada, 2016) that measures an individual’s power to contain incorrect heuristics in favour of deliberation. Several studies have assessed intuition and deliberation using the CRT (e.g., Millet & Aydinli, 2019; Patel, Baker, & Scherer, 2019). For instance, Travers et al. (2016) deployed a mouse-tracking methodology with the CRT. Applying the CRT results suggests that financial traders prefer reflective thinking and use mental heuristics (Thoma, White, Panigrahi, Strowger, & Anderson, 2015). Furthermore, several questionnaire constructs are used in organizations in the health area (e.g., Use of Intuition by Nursing Students Scale and the Emotional Intelligence Level Assessment Scale developed by Turan et al., 2019; the Smith Intuition Instrument developed by Smith, 2007; Cognitive Task Analysis developed by Zehnder, Law, & Schmölzer, 2019; and the Intuitive Eating Scale developed by Duarte, Gouveia, & Mendes, 2016; Multiple Brain Preference Questionnaire developed by Soosalu, Henwood, & Deo, 2019).

Intuition has been predominately measured in the laboratory context and rather than in real-world situations in the organizational field (e.g., visual coherence task developed by Remmers, Topolinski, Buxton, Dietrich, & Michalak, 2017; semantic coherence task developed by Bowers et al., 1990, and applied by Bolte & Goschke, 2005; Topolinski & Strack, 2009a, 2009b, 2009c; Topolinski & Reber, 2010). Overall, people’s ability to judge the veracity of their own intuitions is limited (Leach & Weick, 2018).

## **Discussion**

Previous researchers have claimed that well-known and frequently applied scales such as the CRT are a valid measure of reflective but not of intuitive thinking (Pennycook, Cheyne, Koehler, &

Fugelsang, 2016). Using a series of experiments, Lufityanto et al. (2016) were the first to provide evidence that nonconscious information can boost decision exactness, increase self-confidence, and speed up response times. Previous work has stressed that intuition can be improved unconsciously (Raio et al., 2012). However, Lufityanto et al. (2016) focused on a random-dot-motion task, which is not remotely close to a real-life environment. Thus, there is a need for innovation-driven instruments to measure intuition and its performance in real-life decision making in the organizational context. In this regard, our first cluster provides ideas to explore attitudes such as belief in intuition (e.g., Evans, 2003) that can shape one's preferences for intuitive decision making. Furthermore, those attitudes could be compared between cultures, decision contexts, organizational positions, and gender to explore their impact on decision makers and thus the organizations they serve.

Intuition plays a role in complex situations like entrepreneurship. Entrepreneurial trajectories—especially during the early years—represent insecure human challenges with a complex, nonlinear, iterative, and rapid decision-making nature (e.g., Fellnhofner, 2017). Questionnaire-based research may be influenced by recall negativity bias, so more prospective studies over a longer time horizon are needed. Cluster 2 provides ideas referring to the body as a central messenger of intuition. For instance, manual muscle testing (MMT) is a non-invasive evaluation tool that assesses muscular strength and neuromusculoskeletal integrity. Through muscle response testing (MRT), a specific type of MMT, muscles are tested for neural control and response to semantic stimuli such as spoken lies. MRT has regularly proven significantly effective at differentiating lies from truths when compared to both intuition and chance (Jensen, Stevens, & Burls, 2016). However, this technique has never been applied in any real-world organizational context. Furthermore, the technique of quantifying skin conductance responses showing peripheral

(bodily) signals related to emotions, decisions, and behaviours is another well-established, robust, widely used, and relatively inexpensive method that can be incorporated into organizational research (Christopoulos, Uy, & Yap, 2019). These body instruments could be used to measure intuition within organizational contexts to investigate how individuals know without knowing. For instance, skin conductance levels of managers or entrepreneurs could be tracked via the latest technological tools through online experiments over a longer period of time; their ventures' performances could be used for comparison. This could also be conducted at lower levels of responsibility, such as team leaders, which might radically increase our knowledge of how attitudes in different societies and cultures could impact intuitive decision making in the organizational context.

As to Cluster 3, seniority, leadership, and experts all play crucial roles in intuitive decision making. Tzioti, Wierenga, & van Osselaer (2014) stressed that following intuitive advice (e.g., someone says "my gut tells me so" or "this is what my intuition says") differs depending on advisor *seniority*. There is evidence that decision makers question a priori the worth of intuitive advice; however, intuitively justified advice from senior advisors is more often followed (Tzioti et al., 2014). Based on data aggregated from 28 studies (total  $N = 13,386$ ) to assess the connection between character strengths and economically relevant behaviours, *leadership* is linked with inefficient, anti-social behaviours, risk taking, and trusting one's intuitions. These findings shed light on which types of individuals are likely to be most successful in which decision contexts (Jordan & Rand, 2018). The core idea of intuition is to trust one own's intuition and not others', as they could be subject to biases. However, we can expect some cultural differences. While most studies focus on Western cultures (Brady, Fryberg, & Shoda, 2018; Henrich, Heine, & Norenzayan, 2010), there are also inconsistent findings in intuition studies comparing Eastern and Western cultures (Allinson & Hayes, 2000; Hayes, Allinson, & Armstrong, 2004; Nisbett, Choi, Peng, &

Norenzayan, 2001; Norenzayan, Smith, Kim, & Nisbett, 2002; Savvas, El-Kot, & Sadler-Smith, 2001; Sinclair, 2020b). In this regard, Cluster 3 highlights the importance of training one's intuition on a regular basis to become familiar with one's skills in different (cultural or contextual) settings. Whether individuals' intuition improves over time within the organizational context if they focus on training their intuition for organizational questions has not yet been investigated. Such training could be rather simple; for instance, employees could guess daily sales numbers, customer reactions, and so on. This would be a natural outgrowth of the role play that is already a widely used technique in organizations large and small.

Our intuition allows us to see the bigger picture because it automatically operates in complex situations (Jung, 2014). In line with Cluster 4, the fundamental point of departure is Freud's frequently repeated statement that most decisions are made on an unconscious level. In his highly influential *The Interpretation of Dreams*, Freud emphasized the "royal" communication between our nonconsciousness and consciousness (Hisrich & Jankowicz, 1990; Rodríguez, 2001). Consequently, analysing how managers' or entrepreneurs' dreams are (or are not) correlated with their daily intuitively or analytically driven decision making should enrich our understanding even further. If people pay attention to their dreams, they will be able to tap into the mind's unconscious thinking processes or the intuitive part of the brain. Thus, dreams and hypnosis are potential future avenues to measure intuition's impact on decision making in the organizational context, perhaps through an intimate, intensive research approach with a qualitative focus using dream and day diaries. Such an approach could track and explore in detail how an individual's nonconscious already knows something before any particular event occurs, all without the individual's conscious knowing.

We can only fully analyse decision making if we also examine the unconscious. In line with Cluster 5, the study of magical frameworks shows potential alternative and innovative avenues

(Garcia-Pelegri et al., 2020). In this regard, neuroimaging and neurophysiologic data from functional magnetic resonance imaging, electroencephalography, magnetoencephalography and electrocorticography for assessing brain networks during unconscious and conscious decision making with various connectivity measures, graph theory, and methods that reveal dynamics might lead to further valuable insights (Mashour & Hudetz, 2018). However, this is a cost-intensive option, and a more practical approach could involve analysing people's faces during decision making, because heart rate variability is an intuition receptor (Sinclair, 2020) that can be tracked via the latest remote tools (Alam et al., 2020; Oviyaa, Renvitha, & Swathika, 2020; Qiao, Zulkernine, Masroor, Rasool, & Jaffar, 2021; van der Kooij & Naber, 2019) using evidence accumulator models, as in previous work (e.g., Brunton, Botvinick, & Brody, 2013; Lufityanto et al., 2016). Such analysis could enrich our insights around how intuition unfolds, especially when making uncertain, complex, and risky decisions in organizations. In line with the results from the previous clusters, this research approach could track and explore how individuals' nonconscious knowing by examining micro-level bodily reactions. As our organizational world becomes more complex, shaken by crises, and characterized by uncertainty, time pressure, ambiguity, and instability, this knowledge will be even more important for decision makers.

### *Implications*

The need to quantitatively measure intuition is crucial in many different fields and is especially vital in the organizational context. In workplace hiring, for instance, a new measurement tool for intuition could replace questionnaires that rely on people's opinions about their own feelings about intuition. Scholars stress that intelligence tests are ineffective at assessing appropriate candidates for employment. An intuition measurement could support human resource recruiting to assess candidates' intuition potential. For instance, Glaser (1995) provided evidence that intuition supports individuals working in research and development and that those who use it are more

successful than their colleagues. Furthermore, intuition can play an equally important role in employee performance (Richey, Harvey, & Moeller, 2010). For instance, career guidance and counselling as a component in life orientation are often based on intuition. New intuition measurement instruments could be used for training and staff development to empower employees and adequately prepare them for the new world of work (Dama, Mathwasa, & Mushoriwa, 2019).

### *Limitations*

This work has certain limitations. First, it may be criticized for the enormous body of knowledge it covers and thus potential biases that it risks. Consequently, readers are asked to exercise caution regarding the methods applied. In particular, while bibliographic mapping and visualization have achieved significant acceptance in science, this review covers only peer reviewed publications in two major databases. Despite diverse quality cross-checks, contributions such as reports and books are not taken into account. Moreover, the cluster titles are based on qualitative interpretations, though with the support of quantitative methods. Cluster interpretation is difficult because the borders between clusters are almost inevitably vague, sometimes significantly so. However, by identifying and discussing these clusters, we refer to the most powerful thoughts in the research literature. The recognition of patterns requires further research. In spite of these limitations, this review is the first visualized appraisal and mapping of the research literature on different thinking styles. It emphasizes above all ideas for future research.



## REFERENCES

- Abramson, N. R., Lane, H. W., Nagai, H., & Takagi, H. 1993. A Comparison of Canadian and Japanese Cognitive Styles: Implications for Management Interaction. *Journal of International Business Studies*, 24(3): 575–587.
- Aczel, B., Lukacs, B., Komlos, J., & Aitken, M. R. F. 2011. Unconscious intuition or conscious analysis? Critical questions for the Deliberation-without-Attention paradigm. *Judgment and Decision Making*, 6(4): 351–358.
- Akinci, C., & Sadler-Smith, E. 2019. Collective Intuition: Implications for Improved Decision Making and Organizational Learning. *British Journal of Management*, 30(3): 558–577.
- Alam, K. S., He, L., Ma, J., Das, D., Yap, M., et al. 2020. Remote Heart Rate and Heart Rate Variability Detection and Monitoring from Face Video with Minimum Resources. *Proceedings - 2020 IEEE 44th Annual Computers, Software, and Applications Conference, COMPSAC 2020*, 1385–1390.
- Allinson, C. W., & Hayes, J. 2000. Cross-national differences in cognitive style: Implications for management. *International Journal of Human Resource Management*, 11(1): 161–170.
- Andow, J. 2015. How Distinctive Is Philosophers' Intuition Talk? *Metaphilosophy*, 46(4–5): 515–538.
- Atkinson, A., & Shaffir, W. 1998. Standards for Field Research in Management Accounting. *Journal of Management Accounting Research*, (10): 41–68.
- Banks, G. C., Pollack, J. M., Bochantin, J. E., Kirkman, B. L., Whelpley, C. E., et al. 2016. Management's science-practice gap: A grand challenge for all stakeholders. *Academy of Management Journal*, 59(6): 2205–2231.
- Benner, P., & Tanner, C. 1987. How expert nurses use intuition. *American Journal of Nursing*, 87(1): 23–31.
- Betsch, C. 2004. Präferenz für Intuition und Deliberation - Messung und Konsequenzen von individuellen Unterschieden in affekt- und kognitionsbasiertem Entscheiden. *Zeitschrift Für Differentielle Und Diagnostische Psychologie*, 25(4): 50.
- Bierly, P. E., & Gallagher, S. 2007. Explaining Alliance Partner Selection: Fit, Trust and Strategic Expediency. *Long Range Planning*, 40(2): 134–153.
- 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.
- Bolte, A., & Goschke, T. 2005. On the speed of intuition: Intuitive judgments of semantic coherence under different response deadlines. *Memory and Cognition*, 33: 1248–1255.
- Bowers, K. S., Regehr, G., Balthazard, C., & Parker, K. 1990. Intuition in the context of discovery. *Cognitive Psychology*, 22(1): 72–110.
- Boyack, K. W., & Klavans, R. 2010. Co-citation analysis, bibliographic coupling, and direct citation: Which citation approach represents the research front most accurately? *Journal of the American Society for Information Science & Technology*, 61(12): 2389–2404.
- Brady, L. M., Fryberg, S. A., & Shoda, Y. 2018. Expanding the interpretive power of psychological science by attending to culture. *Proceedings of the National Academy of Sciences of the United States of America*, 115(45): 11406–11413.
- Braun, T. 2005. *Handbook of quantitative science and technology research. The use of publication and patent statistics in studies of S&T systems*. Dordrecht, Netherlands: Springer.
- Brody, F. J., & Trad, K. S. 1997. Comparison of acid reduction in antiulcer operations. *Surgical Endoscopy*, 11(2): 123–125.
- Brunton, B. W., Botvinick, M. M., & Brody, C. D. 2013. Rats and humans can optimally accumulate evidence for decision-making. *Science*, 340(6128): 95–98.
- Bryant, P. 2007. Self-regulation and decision heuristics in entrepreneurial opportunity evaluation and exploitation. *Management Decision*, 45(4): 732–748.
- Buckley, J. W., Buckley, M. H., & H. Chiang. 1976. Research Methodology and Business Decisions. *National Association of Accountants.; Society of Industrial Accountants of Canada*.
- Burmeister, K., & Schade, C. 2007. Are entrepreneurs' decisions more biased? An experimental

- investigation of the susceptibility to status quo bias. *Journal of Business Venturing*, 22(3): 340–362.
- Busenitz, L. W., & Barney, J. B. 1997. Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of Business Venturing*, 12(1): 9–30.
- Bush, I. 2016. Measuring Heart Rate from Video. *Stanford Computer Science*, 8.
- Calabretta, G., Gemser, G., & Wijnberg, N. M. 2017. The interplay between intuition and rationality in strategic decision making: A paradox perspective. *Organization Studies*, 38(3–4): 365–401.
- Cappelen, H. 2012. *Philosophy without Intuitions*. Oxford: Oxford University Press.
- Carter, C. R., Kaufmann, L., & Wagner, C. M. 2017. Reconceptualizing Intuition in Supply Chain Management. *Journal of Business Logistics*, 38(2): 80–95.
- Carter, N. M., Gartner, W. B., & Reynolds, P. D. 1996. Exploring start-up event sequences. *Journal of Business Venturing*, 11(3): 151–166.
- Chai, R. 1996. *Organizational analysis as deconstructive practice*. Walter de Gruyter.
- Christopoulos, G. I., Uy, M. A., & Yap, W. J. 2019. The Body and the Brain: Measuring Skin Conductance Responses to Understand the Emotional Experience. *Organizational Research Methods*, 22(1): 394–420.
- Cushman, F., Young, L., & Hauser, M. 2006. The role of conscious reasoning and intuition in moral judgment: Testing three principles of harm. *Psychological Science*, 17(12): 1082–1089.
- Dama, N. G., Mathwasa, J., & Mushoriwa, T. 2019. Promoting career guidance and counselling of secondary school learners: Implication for policy and practice. *Journal of Human Ecology*, 65(1–3): 52–64.
- Damasio, A. 1994. *Descartes' error: Emotion, rationality and the human brain*. New York: Putnam.
- Dane, E., & Pratt, M. G. 2007. Exploring intuition and its role in managerial decision making. *Academy of Management Review*, 32(1): 33–54.
- Dane, E., & Pratt, M. G. 2012. Conceptualizing and measuring intuition: A review of recent trends. *International Review of Industrial and Organizational Psychology 2009*, 24(1): 1–40.
- Deery, O., Davis, T., & Carey, J. 2015. The Free-Will Intuitions Scale and the question of natural compatibilism. *Philosophical Psychology*, 28(6): 776–801.
- Denes-Raj, V., Epstein, S., Heier, H., & Pacini, R. (1. 1996. Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality and Social Psychology*, 71(2): 390–405.
- Dreyfus, H. L., & Dreyfus, S. E. 2005. Expertise in real world contexts. *Organization Studies*, 26(5): 779–792.
- Duarte, C., Gouveia, J. P., & Mendes, A. 2016. Psychometric Properties of the Intuitive Eating Scale-2 and Association with Binge Eating Symptoms in a Portuguese Community Sample. *International Journal of Psychology and Psychological Therapy*, 16(3): 329–341.
- Eling, K., Griffin, A., & Langerak, F. 2014. Using intuition in fuzzy front-end decision-making: A conceptual framework. *Journal of Product Innovation Management*, 31(5): 956–972.
- Eling, K., Langerak, F., & Griffin, A. 2015. The performance effects of combining rationality and intuition in making early new product idea evaluation decisions. *Creativity and Innovation Management*, 24(3): 464–477.
- Epstein, S. 1994. Integration of the cognitive and the psychodynamic unconscious. *American Psychologist*, 49(8): 709–724.
- Epstein, S. 2010. Demystifying intuition: What it is, what it does, and how it does it. *Psychological Inquiry*, 21(4): 295–312.
- Epstein, S., & 1991. 1991. Cognitive-Experiential Self-Theory: An Integrative Theory of Personality. R. C. Curtis, Editor, *The Relational Self: Theoretical Convergences in Psychoanalysis and Social Psychology*. New York: Guilford Press.
- Eubanks, D. L., Murphy, S. T., & Mumford, M. D. 2010. Intuition as an influence on creative problem-

- solving: The effects of intuition, positive affect, and training. *Creativity Research Journal*, 22(2): 170–184.
- Evans, J. S. B. 2003. Box 1. The belief-bias effect. *Trends in Cognitive Sciences*, 10(7): 454–459.
- Evans, J. S. B. T. 2008. Dual-Processing Accounts of Reasoning, Judgment, and Social Cognition. *Annual Review of Psychology*, 59(1): 255–278.
- Evans, J. S. B. T., & Stanovich, K. E. 2013. Dual-Process Theories of Higher Cognition: Advancing the Debate. *Perspectives on Psychological Science*, 8(3): 223–241.
- Fellnhöfer, K. 2017. The power of passion in entrepreneurship education: Entrepreneurial role models encourage passion? *Journal of Entrepreneurship Education*, 20(1): 58–87.
- Fellnhöfer, K. 2019. Toward a taxonomy of entrepreneurship education research literature: A bibliometric mapping and visualization. *Educational Research Review*, 27: 28–55.
- Frederick, S. 2005. Cognitive reflection and decision making. *Journal of Economic Perspectives*, 19(4): 25–42.
- Fröhlich, M. R., Meyer, G., Spirig, R., & Rettke, H. 2019. When and how do intensive care nurses consider pain in the treatment process of ICU patients? A qualitative study. *Pflege*, 32(5): 249–258.
- Garcia-Pelegrin, E., Schnell, A. K., Wilkins, C., & Clayton, N. S. 2020. An unexpected audience. *Science*, 369(6509): 1424–1426.
- Gielnik, M. M., Frese, M., Graf, J. M., & Kampschulte, A. 2012. Creativity in the opportunity identification process and the moderating effect of diversity of information. *Journal of Business Venturing*, 27(5): 559–576.
- Gigerenzer, G. 2007. *Gut feelings: The Intelligence of the Unconscious*. New York: NY: Penguin.
- Gigerenzer, G., & Goldstein, D. G. 1999. Gigerenzer, G., Todd, P.M., & the ABC Research Group. (1999). *Simple Heuristics That Make Us Smart*, 75–95.
- Gmür, M. 2003. Co-citation analysis and the search for invisible colleges: A methodological evaluation. *Scientometrics*, 57(1): 27–57.
- Gobet, F., & Chassy, P. 2008. Towards an alternative to Benner's theory of expert intuition in nursing: A discussion paper. *International Journal of Nursing Studies*, 45(1): 129–139.
- Graham, J., Haidt, J., & Nosek, B. A. 2009. Liberals and Conservatives Rely on Different Sets of Moral Foundations. *Journal of Personality and Social Psychology*, 96(5): 1029–1046.
- Graham, J., Nosek, B. A., Haidt, J., Iyer, R., Koleva, S., et al. 2011. Mapping the Moral Domain. *Journal of Personality and Social Psychology*, 101(2): 366–385.
- Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M., & Cohen, J. D. 2004. The neural bases of cognitive conflict and control in moral judgment. *Neuron*, 44(2): 389–400.
- Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M., & Cohen, J. D. 2001. An fMRI investigation of emotional engagement in moral judgment. *Science*, 293(5537): 2105–2108.
- Grégoire, D. A., Shepherd, D. A., & Lambert, L. S. 2010. Measuring opportunity-recognition beliefs: Illustrating and validating an experimental approach. *Organizational Research Methods*, 13(1): 114–145.
- Groves, K., Vance, C., & Choi, D. 2011. Examining entrepreneurial cognition: An occupational analysis of balanced linear and nonlinear thinking and entrepreneurship success. *Journal of Small Business Management*, 49(3): 438–466.
- Groves, K., Vance, C., & Paik, Y. 2008. Linking linear/nonlinear thinking style balance and managerial ethical decision-making. *Journal of Business Ethics*, 80(2): 305–325.
- Haidt, J. 2001. The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review*, 108(4): 814–834.
- Haidt, J. 2007. The new synthesis in moral psychology. *Science*, 316(5827): 998–1002.
- Haidt, J., & Joseph, C. 2004. Intuitive ethics: How innately prepared intuitions generate culturally variable virtues. *Daedalus*, 133(4): 55–65.
- Harteis, C., & Gruber, H. 2008. How important is intuition for teaching expertise in the field of adult education? *Studies in the Education of Adults*, 40(1): 96–109.
- Hayes, J., Allinson, C. W., & Armstrong, S. J. 2004. Intuition, women managers and gendered

- stereotypes. *Personnel Review*, 33(4): 403–417.
- Haynie, J. M., Shepherd, D. A., & McMullen, J. S. 2009. An opportunity for me? the role of resources in opportunity evaluation decisions. *Journal of Management Studies*, 46(3): 337–361.
- Henrich, J., Heine, S. J., & Norenzayan, A. 2010. The weirdest people in the world? *Behavioral and Brain Sciences*, 33(2–3): 61–83.
- Hisrich, R. D., & Jankowicz, A. D. 1990. Intuition in venture capital decisions - an exploratory-study using a new technique. *Journal of Business Venturing*, 5(1): 49–62.
- Hodgkinson, G. P., & Sadler-Smith, E. 2018. The dynamics of intuition and analysis in managerial and organizational decision making. *Academy of Management Perspectives*, 32(4): 473–492.
- Hodgkinson, G. P., Sadler-Smith, E., Burke, L. A., Claxton, G., & Sparrow, P. R. 2009. Intuition in Organizations: Implications for Strategic Management. *Long Range Planning*, 42(3): 277–297.
- Hoffrage, U., & Marewski, J. N. 2015. Unveiling the Lady in Black: Modeling and aiding intuition. *Journal of Applied Research in Memory and Cognition*, 4(3): 145–163.
- Hogarth, R. M. 2002. Educating intuition. *Choice Reviews Online*, vol. 39. University of Chicago Press, Chicago.
- Huang, L. 2018. The role of investor gut feel in managing complexity and extreme risk. *Academy of Management Journal*, 61(5): 1821–1847.
- Huang, L., & Pearce, J. L. 2015. Managing the unknowable: The effectiveness of early-stage investor gut feel in entrepreneurial investment decisions. *Administrative Science Quarterly*, 60(4): 634–670.
- Iannello, P., Colombo, B., Germagnoli, S., & Antonietti, A. 2020. Enhancing intuition in problem solving through problem finding. *Handbook of Intuition Research as Practice*: 255–267.
- Jensen, A. M., Stevens, R. J., & Burls, A. J. 2016. Estimating the accuracy of muscle response testing: Two randomised-order blinded studies. *BMC Complementary and Alternative Medicine*, 16(1): 1–11.
- Johnson, J. G., & Raab, M. 2003. Take the first: Option-generation and resulting choices. *Organizational Behavior and Human Decision Processes*, 91(2): 215–229.
- Jordan, M. R., & Rand, D. G. 2018. The role of character strengths in economic decision-making. *Judgment and Decision Making*, 13(4): 382–392.
- Jung, C. G. 2014. Psychological types. In P. University (Ed.), *Psychological Types*: 1–640. Princeton, NJ: H. Read, M. Fordham, & G. Adler.
- Jung, C. G., Baynes, H. G., & Beebe, J. 2016. Psychological types. *Psychological Types*: 1–548. Princeton, NJ: H. Read, M. Fordham, & G. Adler.
- Kahneman, D. 2012. Thinking, fast and slow. *Choice Reviews Online*, 49(10): 49-5972-49–5972.
- Kahneman, D., & Frederick, S. 2012. Representativeness Revisited: Attribute Substitution in Intuitive Judgment. *Heuristics and Biases*: 49–81. Cambridge: Cambridge University Press.
- Kahneman, D., & Klein, G. 2009. Conditions for intuitive expertise: A failure to disagree. *American Psychologist*, 64(6): 515–526.
- Kanze, D., Huang, L., Conley, M. A., & Tory Higgins, E. 2018. We ask men to win and women not to lose: Closing the gender gap in startup funding. *Academy of Management Journal*, 61(2): 586–614.
- Khatri, N., & Ng, H. A. 2000. The role of intuition in strategic decision making. *Human Relations*, 53(1): 57–86.
- Klein, G. 2008. Naturalistic decision making. *Human Factors*, 50(3): 456–460.
- Klein, G., Calderwood, R., & Clinton-Cirocco, A. 2010. Rapid Decision Making on the Fire Ground: The Original Study Plus a Postscript. *Journal of Cognitive Engineering and Decision Making*, 4(3): 186–209.
- Koriat, A., Lichtenstein, S., & Fischhoff, B. 1980. Reasons for confidence. *Journal of Experimental Psychology: Human Learning and Memory*, 6(2): 107–118.
- Kripke, S. 1981. Naming and necessity. *Philosophical Books*, 22(1): 36–37.
- Leach, S., & Weick, M. 2018. Can People Judge the Veracity of Their Intuitions? *Social Psychological and Personality Science*, 9(1): 40–49.
- Lieberman, M. D. 2000. Intuition: A social cognitive neuroscience approach. *Psychological Bulletin*,

126(1): 109–136.

- Lufityanto, G., Donkin, C., & Pearson, J. 2016. Measuring intuition: Nonconscious emotional information boosts decision accuracy and confidence. *Psychological Science*, 27(5): 622–634.
- Machery, E., Mallon, R., Nichols, S., & Stich, S. P. 2004. Semantics, cross-cultural style. *Cognition*, 92(3).
- Manimala, M. J. 1992. Entrepreneurial heuristics: A comparison between high PL (pioneering-innovative) and low PI ventures. *Journal of Business Venturing*, 7(6): 477–504.
- Mashour, G. A., & Hudetz, A. G. 2018. Neural Correlates of Unconsciousness in Large-Scale Brain Networks. *Trends in Neurosciences*, 41(3): 150–160.
- McCarthy, A. M., Schoorman, F. D., & Cooper, A. C. 1993. Reinvestment decisions by entrepreneurs: Rational decision-making or escalation of commitment? *Journal of Business Venturing*, 8(1): 9–24.
- McCraty, R., Atkinson, M., & Bradley, R. T. 2004. Electrophysiological Evidence of Intuition: Part 1. The Surprising Role of the Heart. *Journal of Alternative and Complementary Medicine*, 10(1): 133–143.
- McKelvie, A., Haynie, J. M., & Gustavsson, V. 2011. Unpacking the uncertainty construct: Implications for entrepreneurial action. *Journal of Business Venturing*, 26(3): 273–292.
- Mearman, A. 2011. Who Do Heterodox Economists Think They Are? *American Journal of Economics and Sociology*, 70(2): 480–510.
- Measuring intuition Milton Glaser, Research Technology Management (March–April 1995), pp. 43–46. 1996. *Journal of Product Innovation Management*, 13(1): 72–73.
- Mesterman, E. 1967. Organization in Action. *Organization Science*, vol. 78. New York, NY: McGraw Hill.
- Mikels, J. A., Maglio, S. J., Reed, A. E., & Kaplowitz, L. J. 2011. Should I Go With My Gut? Investigating the Benefits of Emotion-Focused Decision Making. *Emotion*, 11(4): 743–753.
- Miller, K. D. 2007. Risk and rationality in entrepreneurial processes. *Strategic Entrepreneurship Journal*, 1(1–2): 57–74.
- Millet, K., & Aydinli, A. 2019. Cognitive reflection, 2D:4D and social value orientation. *PLoS ONE*, 14(2).
- Mitchell, C. W., & Shuff, I. M. 1995. Personality Characteristics of Hospice Volunteers as Measured by Myers-Briggs Type Indicator. *Journal of Personality Assessment*, 65(3): 521–532.
- Mitteneess, C., Sudek, R., & Cardon, M. S. 2012. Angel investor characteristics that determine whether perceived passion leads to higher evaluations of funding potential. *Journal of Business Venturing*, 27(5): 592–606.
- Myers, D. G. 2007. The powers and perils of intuition. *Tall Tales about the Mind and Brain: Separating Fact from Fiction*. Oxford: Oxford University Press.
- Nayak, A. 2008. On the way to theory: A processual approach. *Organization Studies*, 29(2): 173–190.
- Nichols, S., & Knobe, J. 2007. Moral responsibility and determinism: The cognitive science of folk intuitions. *Nous*, 41(4): 663–685.
- Nisbett, R. E., Choi, I., Peng, K., & Norenzayan, A. 2001. Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review*, 108(2): 291–310.
- Nisbett, R. E., & Wilson, T. D. 1977. Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, 84(3): 231–259.
- No authorship indicated. 1986. Review of Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator. *Contemporary Psychology: A Journal of Reviews*, vol. 31. Palo Alto, CA: Consulting Psychologists. <https://doi.org/10.1037/024196>.
- Norenzayan, A., Smith, E. E., Kim, B. J., & Nisbett, R. E. 2002. Cultural preferences for formal versus intuitive reasoning. *Cognitive Science*, 26(5): 653–684.
- Nutt, P. C. 1999. Surprising but true: Half the decisions in organizations fail. *Academy of Management Executive*, 13(4): 75–89.
- Okoli, J., Watt, J., Weller, G., & Wong, W. B. L. 2016. The role of expertise in dynamic risk assessment: A reflection of the problem-solving strategies used by experienced fireground commanders. *Risk*

- Management*, 18(1): 4–25.
- Osareh, F. 1996. Bibliometrics, citation analysis and co-citation analysis: A review of literature I. *Libri*, 46(3): 149–158.
- Oviyaa, M., Renvitha, P., & Swathika, R. 2020. Real Time Tracking of Heart Rate from Facial Video Using Webcam. *Proceedings of the 2nd International Conference on Inventive Research in Computing Applications, ICIRCA 2020*, 701–706.
- Pacini, R., & Epstein, S. 1999. The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, 76(6): 972–987.
- Patel, N., Baker, S. G., & Scherer, L. D. 2019. Evaluating the Cognitive Reflection Test as a Measure of Intuition/Reflection, Numeracy, and Insight Problem Solving, and the Implications for Understanding Real- World Judgments and Beliefs. *Journal of Experimental Psychology: General*, 148(12): 2129–2153.
- Pennycook, G., Cheyne, J. A., Koehler, D. J., & Fugelsang, J. A. 2016. Is the cognitive reflection test a measure of both reflection and intuition? *Behavior Research Methods*, 48(1): 341–348.
- Peredo, A. M., & McLean, M. 2006. Social entrepreneurship: A critical review of the concept. *Journal of World Business*, 41(1): 56–65.
- Phan Tan, L. 2021. Mapping the social entrepreneurship research: Bibliographic coupling, co-citation and co-word analyses. *Cogent Business and Management*, 8(1): 1896885.
- Phillips, W. J., Fletcher, J. M., Marks, A. D. G., & Hine, D. W. 2016. Thinking styles and decision making: A meta-analysis. *Psychological Bulletin*, 142(3): 260–290.
- Pilkington, A., & Teichert, T. 2006. Management of technology: Themes, concepts and relationships. *Technovation*, 26(3): 288–299.
- Prandelli, E., Pasquini, M., & Verona, G. 2016. In user’s shoes: An experimental design on the role of perspective taking in discovering entrepreneurial opportunities. *Journal of Business Venturing*, 31(3): 287–301.
- Pretz, J. E., Brookings, J. B., Carlson, L. A., Humbert, T. K., Roy, M., et al. 2014. Development and validation of a new measure of intuition: The types of intuition scale. *Journal of Behavioral Decision Making*, 27(5): 454–467.
- Pretz, J. E., & Totz, K. S. 2007. Measuring individual differences in affective, heuristic, and holistic intuition. *Personality and Individual Differences*, 43(5): 1247–1257.
- Pritchard, A. 1969. Statistical bibliography or bibliometrics. *Journal of Documentation*, 25(n/a): 348.
- Qiao, D., Zulkernine, F., Masroor, R., Rasool, R., & Jaffar, N. 2021. Measuring Heart Rate and Heart Rate Variability with Smartphone Camera. *Proceedings - IEEE International Conference on Mobile Data Management*, 2021-June: 248–249.
- Quirk, M. 2006. Intuition and metacognition in medical education: keys to developing expertise. *Education for Health: Change in Learning and Practice*.
- Raio, C. M., Carmel, D., Carrasco, M., & Phelps, E. A. 2012. Nonconscious fear is quickly acquired but swiftly forgotten. *Current Biology*, 22(12): R477–R479.
- Rawls, J. 2017. A theory of justice. *Applied Ethics: A Multicultural Approach: Sixth Edition*. Cambridge, Mass.: The Belknap Press of Harvard University Press.
- Reimer, V., Wegewijs, M. R., Nestmann, K., & Pletyukhov, M. 2019. Five approaches to exact open-system dynamics: Complete positivity, divisibility, and time-dependent observables. *Journal of Chemical Physics*, 151(4).
- Richey, G., Harvey, M., & Moeller, M. 2010. “Marketing Managers” in the context of global supply chains: Functional versus multiple IQ competencies. *Journal of Marketing Channels*, 17(3): 243–262.
- Rodriguez, L. S. 2001. The Interpretation of Dreams [1900]. *Australian & New Zealand Journal of Psychiatry*, 35(3): 396–401.
- Ruth-Sahd, L. A., & Hendy, H. M. 2005. Predictors of novice nurses’ use of intuition to guide patient care decisions. *Journal of Nursing Education*, 44(10): 450–458.

- Sadler-Smith, E. 2016. The role of intuition in entrepreneurship and business venturing decisions. *European Journal of Work and Organizational Psychology*, 25(2): 212–225.
- Sadler-Smith, E., & Shefy, E. 2004. The intuitive executive: Understanding and applying “gut feel” in decision-making. *Academy of Management Executive*, 18(4): 76–91.
- Salas, E., Rosen, M. A., & Diaz-Granados, D. 2010. Expertise-based intuition and decision making in organizations. *Journal of Management*, 36(4): 941–973.
- Salas, E., Rosen, M. A., & DiazGranados, D. 2012. Decision Making in Naturalistic Environments. In S. W. Kozlowski (Ed.), *The Oxford Handbook of Organizational Psychology*, vol. 2: 1349–1381.
- Savvas, M., El-Kot, G., & Sadler-Smith, E. 2001. Comparative study of cognitive styles in Egypt, Greece, Hong Kong and the UK. *International Journal of Training and Development*, 5(1): 64–73.
- Schwenk, C. R. 1984. Cognitive simplification processes in strategic decision-making. *Strategic Management Journal*, 5(2): 111–128.
- Shepherd, D. A., Williams, T. A., & Patzelt, H. 2015. Thinking About Entrepreneurial Decision Making: Review and Research Agenda. *Journal of Management*, 41(1): 11–46.
- Simon, H. A. 1987. Making Management Decisions: the Role of Intuition and Emotion. *Academy of Management Executive*, 1(1): 57–64.
- Sinclair, M. 2011. 1 An integrated framework of intuition. *Handbook of Intuition Research*. UK: Edward Elgar Publishing Ltd.
- Sinclair, M. 2020a. An introduction to intuition theory and practice: a summary and a research agenda. *Handbook of Intuition Research as Practice*. Cambridge: Edward Elgar Publishing.
- Sinclair, M. 2020b. Handbook of Intuition Research as Practice. *Handbook of Intuition Research as Practice*. Massachusetts: Edward Elgar Publishers. <https://doi.org/10.4337/9781788979757>.
- Sinclair, M., & Ashkanasy, N. M. 2005. Intuition: Myth or a decision-making tool? *Management Learning*, 36(3): 353–370.
- Sinclair, M., Ashkanasy, N. M., & Chattopadhyay, P. 2010. Affective antecedents of intuitive decision making. *Journal of Management and Organization*, 16(3): 382–398.
- Sloman, S. A. 1996. The empirical case for two systems of reasoning. *Psychological Bulletin*, 119(1): 3–22.
- Smith, A. 2007. Measuring the use of intuition by registered nurses in clinical practice. *Nursing Standard (Royal College of Nursing (Great Britain) : 1987)*, 21(47): 35–41.
- Smith, W. K. 2014. Dynamic decision making: A model of senior leaders managing strategic paradoxes. *Academy of Management Journal*, 57(6): 1592–1623.
- Smith, W. K., & Tushman, M. L. 2005. Managing Strategic Contradictions: A Top Management Model for Managing Innovation Streams. *Organization Science*, 16(5): 522–536.
- Soosalu, G., Henwood, S., & Deo, A. 2019. Head, Heart, and Gut in Decision Making: Development of a Multiple Brain Preference Questionnaire. *SAGE Open*, 9(1).
- Stanovich, K. E., & West, R. F. 2000a. Advancing the rationality debate. *Behavioral and Brain Sciences*, 23(5): 701–717.
- Stanovich, K. E., & West, R. F. 2000b. Individual differences in reasoning: Implications for the rationality debate? *Behavioral and Brain Sciences*, 23(5): 645–726.
- Thoma, V., White, E., Panigrahi, A., Strowger, V., & Anderson, I. 2015. Good thinking or gut feeling? Cognitive reflection and intuition in traders, bankers and financial non-experts. *PLoS ONE*, 10(4).
- Tilden, V. P., & Tilden, S. 1985. From novice to expert, excellence and power in clinical nursing practice. *Research in Nursing & Health*, 8(1): 95–97.
- Tissington, P., & Flin, R. 2005. Assessing Risk in Dynamic Situations: Lessons from Fire Service Operations. *Risk Management*, 7(4): 43–51.
- Topolinski, S., & Reber, R. 2010. Gaining insight into the “Aha” experience. *Current Directions in Psychological Science*, 19(6): 402–405.
- Topolinski, S., & Strack, F. 2009a. Scanning the “Fringe” of consciousness: What is felt and what is not felt in intuitions about semantic coherence. *Consciousness and Cognition*, 18(3): 608–618.
- Topolinski, S., & Strack, F. 2009b. The analysis of intuition: Processing fluency and affect in judgements

- of semantic coherence. *Cognition and Emotion*, 23(8): 1465–1503.
- Topolinski, S., & Strack, F. 2009c. The Architecture of Intuition: Fluency and Affect Determine Intuitive Judgments of Semantic and Visual Coherence and Judgments of Grammaticality in Artificial Grammar Learning. *Journal of Experimental Psychology: General*, 138(1): 39–63.
- Travers, E., Rolison, J. J., & Feeney, A. 2016. The time course of conflict on the Cognitive Reflection Test. *Cognition*, 150: 109–118.
- Tressoldi, P., & Martinelli, M. 2009. Implicit intuition: how heart rate can contribute to prediction of future events. *Journal of the Society*, 73(894): 1.
- Trevelyan, R. 2008. Optimism, overconfidence and entrepreneurial activity. *Management Decision*, 46(7): 986–1001.
- Tu, S., Miao, C., Gao, Y., Fang, F., Zhuang, Q., et al. 2004. A Novel Cascade Reaction of Aryl Aldoxime with Dimedone under Microwave Irradiation: The Synthesis of N-Hydroxylacridine. *Synlett*, (2): 255–258.
- Turan, N., Özdemir Aydın, G., Özşaban, A., Kaya, H., Aksel, G., et al. 2019. Intuition and emotional intelligence: A study in nursing students. *Cogent Psychology*, 6(1): 1633077.
- Tversky, A., & Kahneman, D. 1974. Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157): 1124–1131.
- Tversky, A., & Kahneman, D. 1981. The framing of decisions and the psychology of choice. *Science*, 211(4481): 453–458.
- Tzioti, S. C., Wierenga, B., & van Osselaer, S. M. J. 2014. The Effect of Intuitive Advice Justification on Advice Taking. *Journal of Behavioral Decision Making*, 27(1): 66–77.
- Van den Broeck, H., Vanderheyden, K., & Cools, E. 2003. Individual Differences in Cognitive Styles: Development, Validation and Cross-Validation of the Cognitive Style Inventory. *Vlerick Leuven Gent Management School*, 38(March 2014): 1573–1592.
- van der Kooij, K. M., & Naber, M. 2019. An open-source remote heart rate imaging method with practical apparatus and algorithms. *Behavior Research Methods*, 51(5): 2106–2119.
- van Eck, N. J., & Waltman, L. 2010. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2): 523–538.
- van Eck, N. J., & Waltman, L. 2014. Visualizing bibliometric networks. In Y. Ding, R. Rousseau, & D. Wolfram (Eds.), *Measuring Scholarly Impact: Methods And Practice*: 285–320. Switzerland: Springer.
- Van Eck, N. J., Waltman, L., Capes, Cnpq, Faperj, et al. 2009. VOSviewer: A computer program for bibliometric mapping. *12th International Conference On Scientometrics And Informetrics, Issi 2009*, 886–897. Rio de Janeiro: International Society for Scientometrics and Informetrics.
- van Leeuwen, T. 2004. Descriptive versus evaluative bibliometrics. *Handbook Of Quantitative Science And Technology Research*: 373–388. Netherlands: Springer.
- Wally, S., & Baum, J. R. 1994. Personal and Structural Determinants of the Pace of Strategic Decision Making. *Academy of Management Journal*, 37(4): 932–956.
- Waltman, L., van Eck, N. J., & Noyons, E. C. M. 2010. A unified approach to mapping and clustering of bibliometric networks. *Journal of Informetrics*, 4(4): 629–635.
- Wang, Y., Highhouse, S., Lake, C. J., Petersen, N. L., & Rada, T. B. 2017. Meta-analytic investigations of the relation between intuition and analysis. *Journal of Behavioral Decision Making*, 30(1): 15–25.
- Waroquier, L., Marchiori, D., Klein, O., & Cleeremans, A. 2010. Is It Better to Think Unconsciously or to Trust Your First Impression? A Reassessment of Unconscious Thought Theory. *Social Psychological and Personality Science*, 1(2): 111–118.
- Weinberg, J. M., Nichols, S., & Stich, S. 2001. Normativity and Epistemic Intuitions. *Philosophical Topics*, 29(1): 429–460.
- White, H. D., & Griffith, B. C. 1981. Author cocitation: A literature measure of intellectual structure. *Journal of the American Society for Information Science*, 32(3): 163–171.
- Williamson, T. 2008. The Philosophy of Philosophy. *The Philosophy of Philosophy*. UK: John Wiley & Sons.



- Witteman, C., Van Bercken, J. Den, Claes, L., & Godoy, A. 2009. Assessing rational and intuitive thinking styles. *European Journal of Psychological Assessment*, 25(1): 39–47.
- Woźniak, A. 2006. Managerial intuition across cultures: Beyond a “West-East dichotomy.” *Education and Training*.
- Zacharakis, A. L., & Meyer, G. D. 1998. A lack of insight: Do venture capitalists really understand their own decision process? *Journal of Business Venturing*, 13(1): 57–76.
- Zacharakis, A. L., & Shepherd, D. A. 2001. The nature of information and overconfidence on venture capitalists’ decision making. *Journal of Business Venturing*, 16(4): 311–332.
- Zacharakis, A., & Shepherd, D. A. 2005. A non-additive decision-aid for venture capitalists’ investment decisions. *European Journal of Operational Research*, 162(3): 673–689.
- Zadeh, L. A. 1965. Fuzzy sets. *Information and Control*, 8(3): 338–353.
- Zehnder, E. C., Law, B. H. Y., & Schmölzer, G. M. 2019. An opportunity for cognitive task analysis in neonatal resuscitation. *Frontiers in Pediatrics*, 7(AUG): 356.
- Zhang, D. C., Highhouse, S., & Rada, T. B. 2016. Explaining sex differences on the Cognitive Reflection Test. *Personality and Individual Differences*, 101: 425–427.
- Zhao, D., & Strotmann, A. 2008. Comparing all-author and first-author co-citation analyses of information science. *Journal of Informetrics*, 2(3): 229–239.

APPENDIX A

**TABLE 1**  
**Top 42 most cited references across research domains**

	Citations	Co-citation links	Cluster
Zadeh, 1965	100	5.00	
Tversky and Kahneman, 1981	105	287.00	
Tversky and Kahneman, 1974	259	796.00	5
Kahneman and Tversky, 1979	142	278.00	
Gigerenzer and Goldstein, 1999	100	328.00	
Williamson, 2008	143	255.00	
Weinberg et al., 2001	114	243.00	
Nichols and Knobe, 2007	112	156.00	
Machery et al., 2004	131	264.00	4
Kripke, 1981	134	140.00	
Cappelen, 2012	103	200.00	
Simon, 1987	115	570.00	
Sadler-Smith and Shefy, 2004	109	491.00	
Lieberman, 2000	129	546.00	
Khatri and Ng, 2000	142	540.00	
Kahneman and Klein, 2009	170	727.00	3
Hogarth, 2001	188	850.00	
Dane and Pratt, 2007	262	978.00	
Bowers et al., 1990	117	319.00	
Rawls, n.d.	195	256.00	
Nisbett and Wilson, 1977	121	348.00	
Haidt, 2007	110	425.00	
Haidt and Joseph, 2004	103	356.00	
Haidt, 2001	421	1320.00	
Greene et al., 2004	121	477.00	2
Greene et al., 2001	217	746.00	
Graham et al., 2011	100	282.00	
Graham et al., 2009	136	369.00	
Damasio, 1994	169	565.00	
Cushman et al., 2006	106	424.00	
Stanovich and West, 2000	221	1128.00	
Sloman, 1996	223	1030.00	
Pacini and Epstein, 1999	140	620.00	
Kahneman, 2011	349	1031.00	
Kahneman, 2003	219	954.00	
Kahneman and Frederick, 2002	120	594.00	
Frederick, 2005	197	683.00	1
Evans and Stanovich, 2013	162	651.00	
Evans, 2003	101	524.00	
Evans, 2008	232	984.00	
Epstein et al., 1996	193	794.00	
Epstein, 1994	201	1018.00	

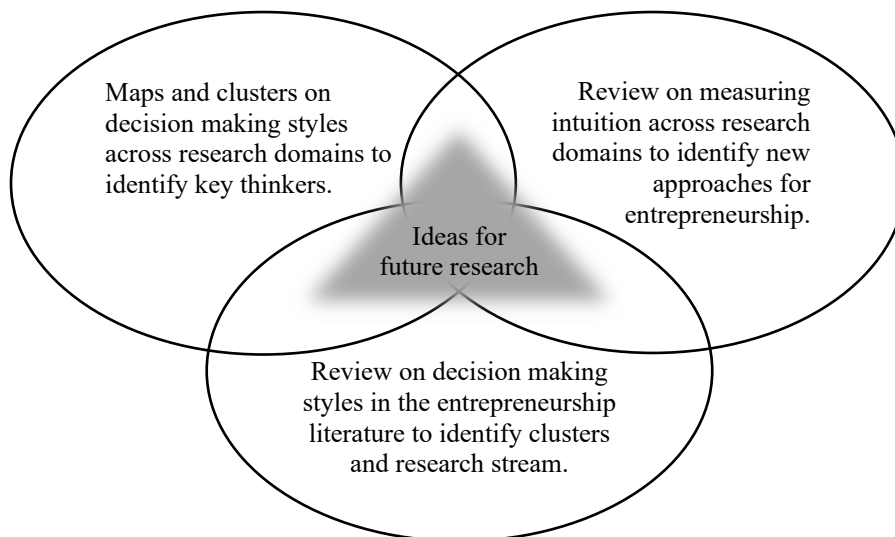
Note. Citations and Co-citations scores are based on VOSviewer's bibliometric multidimensional scaling (van Eck & Waltman, 2009).

**TABLE 2**  
**List of measurement techniques for intuition**

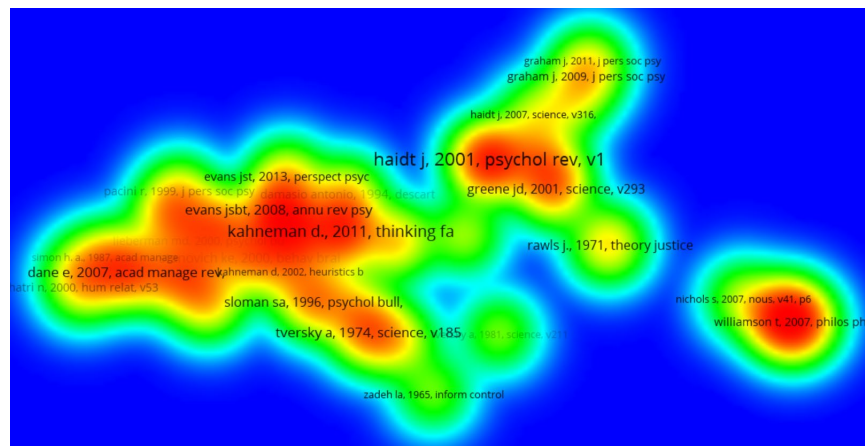
	<b>Amount</b>
Opinion - Individual - Survey	147
Analytic - Internal Logic - Mathematical modelling	32
Archival - Primary - Content Analysis	24
Empirical - Case - Observation	21
Empirical - Field - Time and Motion	5
Empirical - Laboratory - Simulation	5
Archival - Secondary - Sampling	4
Opinion - Group - Delphi	3
	<b>241</b>

**APPENDIX B**

**FIGURE 1**  
**Methodological approach**



**FIGURE 2**  
 Results with five clusters based on citation scores (VosViewer)





**FIGURE 4**  
**Key authors regarding different cognitive style in the entrepreneurship discipline**

