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**Article — Published Version**

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Journal of Management Studies

**Provided in Cooperation with:**

John Wiley & Sons

*Suggested Citation:* Kruse, Sebastian; Bendig, David; Brettel, Malte (2023) : How Does CEO Decision Style Influence Firm Performance? The Mediating Role of Speed and Innovativeness in New Product Development, Journal of Management Studies, ISSN 1467-6486, Wiley, Hoboken, NJ, Vol. 60, Iss. 5, pp. 1205-1235,  
<https://doi.org/10.1111/joms.12913>

This Version is available at:

<https://hdl.handle.net/10419/288015>

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# How Does CEO Decision Style Influence Firm Performance? The Mediating Role of Speed and Innovativeness in New Product Development

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**ABSTRACT** Although chief executive officers (CEOs) are the primary decision-makers in their firms, there has been little research on how CEOs' decision styles affect firm performance. This study explores the relationships between firm performance and two key dimensions of CEO decision style, namely the use of heuristics and decision standards. We conceptualize the speed and innovativeness of new product development (NPD) as mediators in these relationships. An empirical analysis of 1046 German firms indicates that CEOs' use of heuristics may lead to higher NPD speed and stronger firm performance. In addition, higher decision standards, i.e., a stronger tendency to make the best decisions possible, among CEOs may promote higher NPD speed, NPD innovativeness, and firm performance but may also lead to less use of heuristics. Our findings underscore the relevance of CEO decision styles for firm performance and NPD, contribute to the debate on the rationality of heuristics, and conceptually broaden the role of decision standards in decision-making.

**Keywords:** CEOs, decision styles, decision standards, ecological rationality, heuristics, new product development

## INTRODUCTION

The popular media repeatedly claim that the decision styles of Chief Executive Officers (CEOs) crucially influence the performance of their firms (e.g., Bonchek and Fussell, 2013; Brousseau et al., 2006; Zipser, 2019). For example, at Amazon, Jeff Bezos' decision style has been called his 'key to success' (Benson, 2019, p. 1). The astounding growth of firms like Apple, Google, and Tesla has also been attributed in large part to the decision styles of their CEOs (Davenport, 2011; Jackson, 2018; Petrone, 2017). Academic research has

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found that decision style, defined as ‘the response pattern exhibited by an individual in a decision-making situation’ (Thunholm, 2004, p. 941) and sometimes also referred to as cognitive style (e.g., Brigham et al., 2007; Gallén, 2006; Thunholm, 2004), is a time-stable individual difference (Dalal et al., 2015; Schoar and Zuo, 2017). Decision style varies significantly among CEOs (Bertrand and Schoar, 2003) and is closely linked to their actual choices (Henderson and Nutt, 1980; Hough and Ogilvie, 2005; Hunt et al., 1989; Nutt, 1990, 2006). However, with very few exceptions (e.g., Judge Jr. and Dobbins, 1995; Miller and Toulouse, 1985; Sadler-Smith, 2004), there has been a dearth of research on the relationship between CEOs’ decision styles and organizational performance. This is surprising, given that such research may inform theoretical debates about which CEO decision-making behaviours are most valuable to firms and extend prior studies focused mainly on CEOs’ demographics or personalities as determinants of firm performance (e.g., Chatterjee and Hambrick, 2007; Hambrick and Mason, 1984; Markóczy, 1997; Miller et al., 1982; Miller and Toulouse, 1986). Understanding how CEOs’ decision styles influence organizations is also relevant for practitioners since decision styles can be consciously adapted (Brousseau et al., 2006). Thus, with the proper knowledge, CEOs may be able to adapt their styles to make their firms more successful.

This paper aims to advance knowledge about the relationship between CEOs’ decision styles and organizational performance by addressing three research gaps. First, scholars and practitioners agree that CEOs often use heuristics (Bettis, 2017) – simple decision rules that disregard some of the available information (Gigerenzer and Gaissmaier, 2011). Yet it is unclear whether this is beneficial or detrimental for firms (for a review, see Looch and Hinnen, 2015). While management scholars argue that heuristics promote fast but biased and ineffective choices (Dean and Sharfman, 1996; Kahneman, 2003), some heuristic scholars suggest that the benefits of heuristics depend on their fit with their decision environment, i.e., on their ecological rationality (Artinger et al., 2015; Luan et al., 2019). Examining the relationship between CEOs’ use of heuristics and firm performance may shed new light on this theoretical debate by providing novel insights into the ecological rationality of heuristics in a management context.

Second, a crucial dimension of decision style is decision standards – the degree to which decision-makers aspire to make the best decisions possible (Gigerenzer, 2008). However, prior work has considered decision standards mainly as triggers for additional information search (e.g., Gigerenzer and Gaissmaier, 2011) and has not explored whether they directly influence organizational outcomes. Studying how heuristics and decision standards jointly shape firm success could provide more comprehensive models of CEOs’ decision styles and illuminate the interrelationship between decision standards and heuristics.

Third, one key channel through which CEOs’ decision styles may potentially affect firm performance is new product development (NPD). Because NPD decisions are complex and uncertain (Atuahene-Gima and Li, 2004), firms have only a limited ability to establish organizational routines (Brown and Eisenhardt, 1997) and individual differences in decision-making become more relevant (McCarthy et al., 2006). NPD is also pivotal for competitive advantage and firm survival (e.g., Kessler et al., 2000; Zirger and Maidique, 1990) and is strongly influenced by CEOs’ choices (Back and Bausch, 2019), indicating that CEOs’ decision styles may shape firm performance through their influence

on NPD. However, very few studies (e.g., de Visser & Faems, 2015) have explored the relationship between CEOs' decision styles and NPD. Investigating this relationship may explain when and where heuristics and higher decision standards are valuable (Loock and Hinnen, 2015) and shed light on the understudied role of individual decision-making in NPD (Furr and Eggers, 2021).

The purpose of this paper is to examine the influence of two key dimensions of CEOs' decision styles – the use of heuristics and decision standards – on NPD speed, NPD innovativeness, and, ultimately, firm performance. We focus on NPD speed and innovativeness as mediators to investigate whether heuristics and decision standards influence firm performance by accelerating NPD processes or by improving their effectiveness. Our empirical analysis of 1046 German firms suggests that the use of heuristics by CEOs is associated with higher NPD speed and stronger firm performance but not with NPD innovativeness. Our results also indicate that higher decision standards among CEOs are related to higher NPD speed, greater NPD innovativeness, and stronger firm performance. At the same time, CEOs with higher decision standards appear to rely less on heuristics, resulting in a small negative effect on firm performance.

Our study makes four contributions to the literature on managerial decision-making. First, our large-scale empirical analysis suggests that heuristics may be effective decision tools for CEOs. We thus answer research calls for more generalizable evidence about the ecological rationality of heuristics in management contexts (Luan et al., 2019) and question the normative ideal of systematic and thorough decision-making for managers (Cabantous and Gond, 2011). Second, our results indicate that CEOs' use of heuristics may benefit firms by accelerating processes (higher NPD speed) rather than making them more effective (no relationship with NPD innovativeness). We thus add to the scarce work on how managers' use of heuristics provides value for firms (Loock and Hinnen, 2015) and question the existence of a trade-off between accuracy and effort when using heuristics. Third, we suggest that CEOs' decision standards may be an understudied determinant of organizational performance. Our evidence for a positive link between higher decision standards among CEOs and firm performance challenges the implicit assumption in the management literature that all managers have equally high standards when making choices (Dean and Sharfman, 1993; Jensen and Meckling, 1994) and highlights the need to include decision standards in new models of managerial decision-making. Fourth, prior work on decision-making has mainly viewed decision standards as triggers for more information search (e.g., Gigerenzer and Gaissmaier, 2011). We extend this work by suggesting that higher standards are also associated with more risk-seeking behaviour, and thus directly impact organizational outcomes.

The remainder of this paper is structured as follows. In the theory section, we review prior work on the two focal dimensions of decision styles – the use of heuristics and decision standards – and summarize the role of CEO decision-making in NPD. We then present six mediation hypotheses that link CEOs' use of heuristics and decision standards to firm performance through NPD speed and innovativeness. Finally, we turn to our empirical results and discuss the implications and limitations of our study.

## THEORY

### Heuristics

Heuristics are simple decision rules that ignore some of the available information (Gigerenzer and Gaissmaier, 2011). They are the focus of two main research programmes in the psychology literature: heuristics-and-biases and fast-and-frugal heuristics. The simple rules approach applies fast-and-frugal principles to the study of organizational heuristics in the management literature. We proceed by reviewing these three different perspectives on heuristics, which derive from the same body of work (Simon, 1955, 1956) but offer complementary views of how heuristics have evolved as decision-making tools for boundedly rational decision-makers (for a comprehensive review, see Bingham and Eisenhardt, 2014).

*Heuristics-and-biases.* The heuristics-and-biases approach examines whether individuals use normatively correct, i.e., Bayesian, reasoning when faced with statistical information; studies generally find that individuals often instead use heuristics (Gilovich et al., 2012; Tversky and Kahneman, 1974), such as availability and representativeness (Kahneman and Tversky, 1972; Tversky and Kahneman, 1973). These heuristics are viewed as part of a Type 1 information processing system, which makes decisions automatically, subconsciously, and effortlessly. The use of heuristics is often contrasted with Type 2 information processing, characterized by slow, effortful, and deliberate decision-making (Kahneman, 2011). These two systems are viewed as qualitatively distinct and complementary approaches (for a review, see Hodgkinson and Sadler-Smith, 2018). Heuristics-and-biases scholars acknowledge that heuristics save time and effort but argue that they lead to biased and inferior choices (Kahneman et al., 2011). Thus, the use of heuristics should be avoided if possible (Kahneman, 2003; Maule and Hodgkinson, 2002). Influenced by the heuristics-and-biases approach, the management literature also equates heuristics with a trade-off between accuracy and effort (e.g., Dean and Sharfman, 1993; Haley and Stumpf, 1989) and regards systematic and deliberate decision-making as a normative ideal (for reviews, see Cabantous and Gond, 2011; Samba et al., 2021).

*Fast-and-frugal.* Unlike their heuristics-and-biases colleagues, fast-and-frugal scholars do not accept the existence of two distinct types of information processing systems and propose instead that heuristics and slow, deliberate decision-making are two ends of a single decision-making continuum (e.g., Kruglanski and Gigerenzer, 2011; Mega et al., 2015). The heuristics studied in this approach, such as take-the-best, tallying, and satisficing (Gigerenzer, 2008), consist of explicit decision rules (Artinger et al., 2015), are often used consciously by decision-makers (Gigerenzer and Gaissmaier, 2011), and are described as having no inherent downside (Gigerenzer and Todd, 1999); instead, their effectiveness depends on their ecological rationality (Mousavi and Kheirandish, 2014; Todd and Gigerenzer, 2007), i.e., on their fit with the specific structure of the decision environment. Fast-and-frugal heuristics can lead to faster and more accurate decisions if they exploit environmental features (Gigerenzer and Brighton, 2009), such as by focusing on the most relevant decision cues and ignoring noisy information (Artinger et al., 2015). Since many

business environments are uncertain (Artinger et al., 2015), these heuristics can be effective decision tools for managers (Ehrig and Schmidt, 2021; Guercini and Lechner, 2021). However, since fast-and-frugal studies generally use simulations to study single choices (e.g., Brandstätter et al., 2006), claims for the ecological rationality of managerial heuristics have been limited to specific heuristics and decision contexts (Luan et al., 2019).

*Simple rules.* Simple rules scholars apply the ecological rationality perspective of fast-and-frugal scholars to the study of shared organizational heuristics in firms (Bingham et al., 2007). In particular, simple rules scholars examine how shared heuristics allow firms to capture opportunities when opportunities are abundant, heterogeneous, and fast-moving (Bingham and Eisenhardt, 2011). The heuristics studied are unique, specific to firms, often consciously understood, and explicitly shared among a firm's staff (Bingham and Eisenhardt, 2014). For instance, firms can develop heuristics that focus attention (e.g., 'limit internationalization to Europe') or guide the execution of opportunities (e.g., 'always use acquisitions to enter new countries') (Bingham and Eisenhardt, 2011). The simple rules approach has made important contributions by explaining how shared heuristics emerge (e.g., Bingham and Halebian, 2012). However, because of this emphasis on the emergence of heuristics, 'there is surprisingly little systematic research on when and how management heuristics provide value' to firms (Loock and Hinnen, 2015, p. 2034).

In this study, we adopt the ecological rationality perspective of fast-and-frugal and simple rules scholars (Todd and Gigerenzer, 2007), thus viewing heuristics as fundamentally adaptive decision tools in managerial settings (Artinger et al., 2015; Furr et al., 2020). Consistent with previous work on fast-and-frugal heuristics (Kruglanski and Gigerenzer, 2011), we conceptualize the use of heuristics as one side of a decision-making continuum that distinguishes between heuristics and more complex decision-making. We also expect a link between a CEO using heuristics as part of their decision style and the implementation of simple rules in organizations: Since decision styles reflect time-stable and habitually learned behaviours (Scott and Bruce, 1995; Thunholm, 2004), we expect CEOs who habitually use heuristics for individual choices also to structure their organizations using heuristics. The link between CEOs' use of heuristics and the implementation of simple rules builds on extant literature showing that heuristics emerge from personal experience (Eisenhardt and Sull, 2001; Guercini et al., 2015) and that CEOs often author, share and implement simple rules (Atanasiu et al., 2022; Bingham et al., 2019; Eisenhardt and Sull, 2001).

### **Decision Style: Decision Standards**

Besides differences in how they use heuristics, we also examine the decision standards CEOs aspire to. Decision standards reflect decision-makers' aspirations to make the best choice possible (Schwartz et al., 2002) and have received the most attention from fast-and-frugal scholars (e.g., Gigerenzer, 2008). Decision standards are reflected in the stopping rules of formal decision-making models (Gigerenzer and Gaissmaier, 2011), which specify whether decision-makers continue to search for more information or select specific options that they have found. Fast-and-frugal studies generally find that higher

decision standards induce more information-seeking because decision-makers must find and evaluate more options to select options that meet their standards (e.g., Artinger et al., 2015; Luan et al., 2019). Decision standards have received relatively little attention in management research since most prior work has assumed that managers have similarly high standards and will always aim to make the best possible decisions for their firms (Dean and Sharfman, 1993; Jensen and Meckling, 1994).

### **Decision-Making in NPD**

Most decisions made in organizations are small in magnitude, repeated regularly, and provide immediate performance feedback (Kahneman and Lovallo, 1993). Firms manage these decisions by establishing routines – specific and detailed action steps that minimize the influence of individual decision-making (Cohen et al., 1996; Nelson and Winter, 1982). In contrast, decisions in NPD are often complex, uncertain, and without immediate feedback (Atuahene-Gima and Li, 2004). These factors make it harder to develop routines for NPD and increase the influence of individual differences in decision-making (McCarthy et al., 2006).

Prior work suggests that CEOs have both direct and indirect influence on NPD (Back and Bausch, 2019) and that individual differences in their decision-making may thus affect NPD outcomes (Furr and Eggers, 2021). CEOs can directly influence NPD by selecting which projects are developed and deciding on each project's scope, timeline, and resource endowment (Leithold et al., 2015; Unger et al., 2012). Meanwhile, they can indirectly influence NPD by shaping the processes used to structure it (e.g., Barney et al., 2018; Gomes et al., 2001) and deciding on their firm's incentive structure, which affects NPD outcomes (Chen, 2015; Malek et al., 2020). Since CEOs can influence NPD both directly and indirectly, especially in small firms (Leithold et al., 2015), we include both types of influence in our hypotheses.

Lastly, NPD is an essential mechanism through which firms adapt to changing environments and is closely linked with overall firm performance (e.g., Chen et al., 2012). A fundamental trade-off exists between higher speed and greater innovativeness in NPD (Sheng et al., 2013). Examining how differences in CEOs' use of heuristics and decision standards affect this trade-off may shed light on the specific mechanisms through which heuristics and decision standards influence firm performance.

Figure 1 illustrates the proposed relationships between CEOs' use of heuristics, their decision standards, NPD speed and innovativeness, and firm performance. In the next section, we derive six mediation hypotheses that describe the proposed theoretical mechanisms linking the use of heuristics and decision standards among CEOs to NPD speed, NPD innovativeness, and firm performance.

## **HYPOTHESES**

### **CEOs' Use of Heuristics, NPD Speed, and Firm Performance**

We propose that NPD speed mediates the relation between CEOs' use of heuristics and firm performance. We expect CEOs who depend more on heuristics as part of their

### Conceptual Model

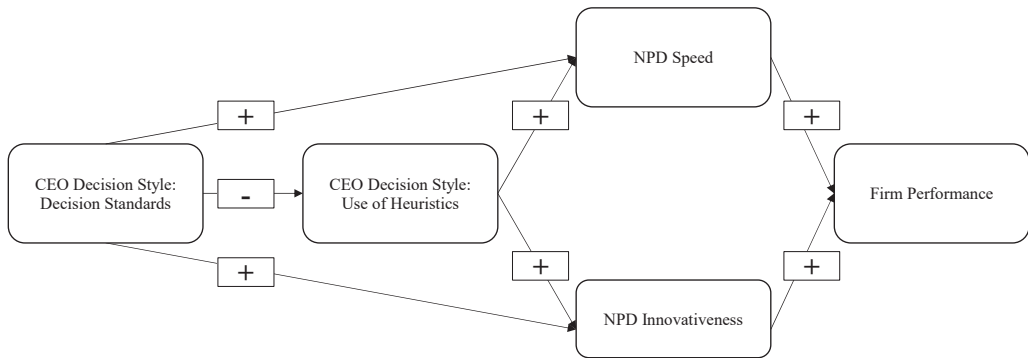


Figure 1. Conceptual model

decision style to promote NPD speed using two types of simple rules: procedural and temporal heuristics.

The first type of simple rules, procedural heuristics, promote speed by enhancing efficiency and avoiding errors while maintaining flexibility (Bingham et al., 2007). For example, CEOs may require that all NPD teams meet weekly, accelerating NPD by promoting coordination and cooperation (e.g., Hoegl et al., 2004; Keller, 2001) as well as flexible problem-solving and improvisation (Akgün and Lynn, 2002; Eisenhardt and Tabrizi, 1995). CEOs may also require NPD team members to meet regularly with customers (Brown and Eisenhardt, 1997), ensuring that new product features will be accepted by the market and avoiding time-intensive product re-specifications (e.g., Carbonell et al., 2009; Vandenbosch and Clift, 2002). In contrast, CEOs who use fewer procedural heuristics may over-structure their NPD processes, reducing NPD speed by limiting the flexibility to react to unforeseen events (Okhuysen and Eisenhardt, 2002; van Oorschot et al., 2018).

The second type of simple rules, temporal heuristics, are related to the timing of NPD activities (Bingham and Eisenhardt, 2011). Temporal heuristics may set a specific pace for NPD, such as by stipulating that development must be finished within 12 months, or they may create a specific rhythm for NPD, such as by requiring that a new product be launched every 24 months. Temporal heuristics increase NPD speed by creating a constant, expected sense of urgency, which is helpful for progress in creative processes (Gersick, 1989). Temporal heuristics also set a constant pace and rhythm that allows for the more efficient integration of internal and external stakeholders. For example, Apple can seamlessly integrate suppliers into new products because of its strict 24-month release cycle (Gereffi and Lee, 2012). Temporal heuristics can further improve speed by smoothing the transition between NPD projects. When firms maintain a constant pace and rhythm, selecting a sufficient number of suitable employees for a new project is easier, and project delays can be avoided (van Oorschot et al., 2013). Planned transitions from old to new projects also make it possible to combine new and experienced staff, ensuring that lessons learned are transferred over time and errors are not repeated (Brown and Eisenhardt, 1997), which promotes NPD speed.



Higher NPD speed, in turn, allows firms to achieve high performance by capturing market share in new and highly profitable market segments (e.g., Cordero, 1991; Vandenbosch and Clift, 2002) and by building barriers to entry for competitors in these segments (e.g., Kardes et al., 1993; Lee et al., 2000; Lieberman and Montgomery, 1988). Higher NPD speed also enables the quick adaptation of existing products to prolong their lifecycles (Akgün et al., 2012), thus contributing to firm performance in existing markets. Even though speed needs to be balanced with other goals in NPD (Langerak and Hultink, 2006), we follow the majority of prior work in proposing a positive relationship between NPD speed and firm performance (for a review, see Cankurtaran et al., 2013). In sum, we hypothesize,

*Hypothesis 1:* NPD speed mediates the relationship between CEOs' use of heuristics and firm performance, such that a greater use of heuristics is associated with higher NPD speed and stronger firm performance.

### **CEOs' Use of Heuristics, NPD Innovativeness, and Firm Performance**

The quest for higher innovativeness in NPD is often described as a search for higher peaks in a 'rugged landscape' (Levinthal, 1997). CEOs face the challenge of providing structure to NPD to find higher peaks of innovativeness (for a review, see Baumann et al., 2019). We propose that CEOs who use more heuristics as part of their decision style are likely to use three types of simple rules to guide firms' efforts to find more innovation peaks.

First, such CEOs may use selection heuristics to constrain search to specific areas in the landscape. Selection heuristics may restrict attention to specific types of technology (e.g., 'Only develop software products') or customers (e.g., 'Do not make products for end customers') (Eisenhardt and Sull, 2001) or establish a few simple criteria that new product ideas must meet. Restricting attention to specific landscape areas improves search efficiency and increases the probability of finding higher peaks (e.g., Gavetti and Levinthal, 2000; Ghemawat and Levinthal, 2008; Welter and Kim, 2018). In contrast, we expect CEOs who rely less on heuristics in their decision styles to employ fewer selection heuristics in NPD, which may decrease efficiency in their firms' search processes and lower the likelihood of finding peaks.

Second, CEOs who use more heuristics are likely to implement priority heuristics in NPD to make efficient choices between opportunities. CEOs may require that new ideas be evaluated by enumerating their advantages and disadvantages (Jetter and Albar, 2013) or by comparing expected customer value with expected development costs (Schiffels et al., 2018). Priority heuristics can evaluate the viability of new ideas as precisely as, but much faster than, complex analyses (Jetter and Albar, 2013), thus freeing up resources to search larger landscape areas. In contrast, more information-intensive analyses reduce the resources available for further search and are unlikely to improve idea selection (West et al., 2020).

Third, heuristics-prone CEOs may implement procedural heuristics that increase innovativeness by encouraging efficient experimentation. For example, 3M allows employees to spend 15 per cent of their time exploring their own ideas (Garud et al., 2011), encouraging the generation of new ideas with limited resources. CEOs may also encourage small experimental projects to create radically new products or may assign experienced specialists to efficiently guide search processes (Brown and Eisenhardt, 1997). Small test projects allow NPD teams to experiment with novel

ideas while limiting resource commitments (Thomke, 1998), and technical or marketing specialists can guide the efficient exploration of distant landscape areas with their unique expertise (Griffin et al., 2009).

Greater innovativeness in NPD allows firms to develop products that offer substantial customer advantages (Calantone et al., 2006; Langerak et al., 2004). Product advantages allow firms to defend their existing markets against competitors and to enter new customer segments, resulting in higher sales and profitability (e.g., Bayus et al., 2003; Henard and Szymanski, 2001; Pauwels et al., 2004). We thus concur with the majority of prior empirical work in proposing a positive link between NPD innovativeness and firm performance (Langerak et al., 2004; Montoya-Weiss and Calantone, 1994; Talke et al., 2010) and hypothesize,

*Hypothesis 2:* NPD innovativeness mediates the relationship between CEOs' use of heuristics and firm performance, such that greater use of heuristics is associated with greater NPD innovativeness and stronger firm performance.

### **CEO Decision Standards, NPD Speed, and Firm Performance**

In addition to being influenced by CEOs' use of heuristics, NPD may also be affected by differences in CEOs' decision standards. CEOs with high decision standards strive to achieve the best possible outcome with each decision (Cheek and Schwartz, 2016; Luan and Li, 2017). However, this is an almost impossible ideal in practice (Luan and Li, 2017). Decision-makers with high standards thus typically cannot achieve the outcomes they aspire to, and feel that they underperform relative to their aspirations (Dalal et al., 2015; Schwartz et al., 2002). Prior work has established that decision-makers interpret an underperformance relative to their aspiration level as a loss situation and tend to become risk-seeking to avoid this (Kahneman and Tversky, 1979; Thaler and Johnson, 1990). Since CEOs with high standards will underperform relative to their aspirations most of the time, we expect these CEOs to display chronic risk-seeking behaviour. Prior work supports this argument since higher decision standards have been repeatedly linked to risk-seeking behaviour (e.g., Hsieh and Yalch, 2020; Qiu et al., 2020).

Due to their risk-seeking behaviour, CEOs with higher decision standards are likely to promote NPD speed. Risk-seeking CEOs find it psychologically easier to commit extensive resources to uncertain NPD projects, which signals their commitment to innovation and provides their NPD teams with higher funding and more personnel for fast development (Shan et al., 2016; Swink, 2003). Because CEOs with higher standards feel time-pressured to improve their performance vis-à-vis their aspiration levels, such CEOs may also accelerate NPD speed by adopting formal goals for time achievements (Chen et al., 2010; Kessler and Chakrabarti, 1996) and by monitoring these goals closely (Carbonell and Escudero, 2011; Menon et al., 2002). Prior work has documented the benefits of higher NPD speed for firm performance (e.g., Cankurtaran et al., 2013). Thus, we hypothesize,

*Hypothesis 3:* NPD speed mediates the relationship between CEO high standards and firm performance, such that higher standards among CEOs are associated with higher NPD speed and higher firm performance.

### **CEO Decision Standards, NPD Innovativeness, and Firm Performance**

Besides promoting speed in NPD, the risk-seeking behaviour of CEOs with higher decision standards may also enhance NPD innovativeness. CEOs with higher standards will be more attracted to business opportunities with very high potential gain, focusing on their upsides and discounting associated risks (Hsieh and Yalch, 2020). In contrast, such CEOs will be less attracted to opportunities with smaller gains, even if these gains can be realized with little effort (Luan and Li, 2017). Since highly innovative NPD projects generally have high risks and high rewards (Sorescu et al., 2003; Sorescu and Spanjol, 2008), CEOs with higher decision standards will select more innovative projects for their NPD portfolios. These CEOs may also visibly champion such projects, further encouraging innovation (Potts, 2010). Our proposed link between aspiration levels, risk-taking, and innovation is consistent with the organizational literature on problemistic search, which finds that firms underperforming relative to their aspiration levels increase innovation efforts (Greve, 1998, 2003; Singh, 1986). Taking on more innovative projects will likely promote firm performance because the outcome distribution of such projects is highly skewed, and a few successful projects can compensate for many failed ones (Fleming, 2007; Furr and Eggers, 2021). Thus, we hypothesize,

*Hypothesis 4:* NPD innovativeness mediates the relationship between high standards among CEOs and firm performance, such that higher standards among CEOs are associated with greater NPD innovativeness and stronger firm performance.

### **CEO Decision Standards, CEOs' Use of Heuristics, NPD Speed, NPD Innovativeness, and Firm Performance**

So far, we have argued that higher decision standards among CEOs lead to higher NPD speed, greater NPD innovativeness, and stronger firm performance. However, we also suspect that CEOs with higher decision standards will rely less on heuristics, which may negatively affect firm performance by reducing NPD speed and innovativeness.

Fast-and-frugal studies argue that when decision-makers have high decision standards, they collect more information before choices can be made (e.g., Luan et al., 2014). This, in turn, suggests that CEOs with higher standards may rely less on heuristics and employ relatively more comprehensive decision-making. The literature on organizational behaviour also links higher decision standards with more information search: The adoption of high organizational goals triggers search behaviour among employees (e.g., Greve, 2003; Sitkin et al., 2011), suggesting a link between higher goals and more comprehensive information gathering and thus less reliance on heuristics. Accordingly, we expect higher decision standards among CEOs to be associated with lower use of heuristics

and, consequently, lower NPD speed, decreased NPD innovativeness, and weaker firm performance. We hypothesize,

*Hypothesis 5:* CEOs' use of heuristics and NPD speed mediate the relationship between CEO decision standards and firm performance, such that higher standards among CEOs are associated with less use of heuristics, lower NPD speed, and weaker firm performance.

*Hypothesis 6:* CEOs' use of heuristics and NPD innovativeness mediate the relationship between CEO decision standards and firm performance, such that higher decision standards among CEOs are associated with lower use of heuristics, decreased NPD innovativeness, and weaker firm performance.

## METHODS

### Sample

We focus on firms between five and ten years old. There are several reasons for this. First, decision-making authority in young firms is often highly centralized, allowing CEOs to make a majority of strategic choices (Miller and Toulouse, 1985). This increases the influence of CEO decision-making on firm performance (Kets De Vries and Miller, 1984). Second, young firms tend to be small, further reinforcing the influence of their CEOs' decision styles on performance (Miller et al., 1982). Third, NPD is crucial for the success of young firms, which often use innovation strategies to achieve competitive advantage (Miller and Toulouse, 1985; Protogerou et al., 2017). Fourth, even though firms between five and ten years old are young, they display consistent behaviours and structure (Merz and Sauber, 1995), and their performance can be evaluated by accepted measures of growth and profitability (Lubatkin et al., 2006). Lastly, CEOs in larger and more mature firms are notoriously hard to reach (e.g., Cycyota and Harrison, 2006; Finkelstein et al., 2009). Therefore, surveying CEOs in younger firms allows us to obtain a large sample of respondents to test our predictions.

We identified sample firms using the Creditreform database, which is based on the German national register of companies (*Handelsregister*). In the first step, we selected all active firms in the manufacturing and service industries with electronic contact information (23,590 firms). We randomly selected and contacted 1000 firms to conduct a pre-test in late 2018 and sent emails to the remaining 22,590 firms in early 2019. When direct contact information was available, we wrote directly to the CEO. Otherwise, we requested that our email be passed on to the CEO. 20,671 emails were delivered successfully, resulting in 1951 responses, a 9.4 per cent response rate. We validated our information about firm age with a primary measure and dropped all firms that did not provide information regarding their age (209) or fell outside our desired age range (492). We dropped respondents who were unengaged (1) or who left out more than 5 per cent of the core construct (41) or control variable (85) items. We also dropped respondents who were not executives (62) or did not indicate their current position (15).

Most of our respondents were male (919) and the founders of their companies (941). On average, our respondents were 47.3 years old and had been with their firms for 8.5 years. 772 of our respondents self-assessed as CEOs, while 274 identified themselves as managing directors (*Geschäftsführer*), a term often used interchangeably with *CEO* in Germany. We thus kept the 274 managing directors and controlled for the effect of non-CEO status.

We tested for non-response bias by partitioning our sample into three equal groups based on response time (Berg, 2005). We compared early and late respondents' gender, age, firm age, and size. We found statistically significant differences for respondent age ( $p = 0.09$ , early: 46.7 years, late: 47.8 years) and firm age ( $p = 0.07$ , early: 8.5 years, late: 8.7) but judged these differences to be very small. We found a statistically significant difference in firm size ( $p = 0.07$ , early: 18.3 employees, late: 13.4 employees). Our sample may thus reflect slightly larger firms than the population. We did not find a statistically significant effect for gender. Finally, our sample closely approximates the structure of the total population of German firms we intended to study: 30 per cent of our sample firms are in manufacturing (as are 35 per cent of our target population), 6 per cent in transportation (4 per cent), 5 per cent in IT and telecommunication (6 per cent), and 59 per cent in service industries (55 per cent).

## Measures

We used established scales for our variables and translated each scale from English to German using back-translation (Brislin, 1970). We discussed these translated scales with three management consultants to ensure comprehensibility and refined all items based on the feedback from a pre-test with 1000 randomly selected firms. All items are measured using seven-point Likert scales. We show item descriptions and minimum and maximum values for our main constructs in Table I.

*CEO decision style: Use of heuristics.* In this paper, we follow prior work on fast-and-frugal heuristics and conceptualize decision-making as a continuum (Kruglanski and Gigerenzer, 2011): One side of this continuum indicates the use of heuristics, i.e., gathering little information and relying on simple rules of thumb. The other side reflects more comprehensive information gathering and more complex analyses, i.e., less use of heuristics. We measure CEOs' use of heuristics using the alternative search scale developed by Durinik et al. (2018) because this scale captures time-stable individual differences in gathering information and conducting complex analyses on a continuous scale. Prior empirical studies point to the validity of alternative search as a proxy for using heuristics. Alternative search predicts how many decision options individuals consider when making actual choices (Hughes and Scholer, 2017; Rim, 2012; Rim et al., 2011), how thoroughly they analyse these options (Harris et al., 2021) and how much time and effort they spend on decision-making (Potts, 2010). All these decision behaviours are likely to result from differences in the use of heuristics.

Since alternative search directly asks respondents to rate their decision-making behaviour, the scale reflects differences in the conscious and individual use of heuristics. We therefore expect the scale to measure the use of fast-and-frugal heuristics, which reflect individual behaviour and are often used consciously (Gigerenzer and Gaissmaier, 2011). The heuristics studied in the heuristics-and-biases research program are mostly used unconsciously (Kahneman, 2011) and are thus unlikely to be

Table I. Survey items

**ALTERNATIVE SEARCH**

(Min: 1.40, max: 7.00; source: Durinik et al., 2018)

- Before making a decision, I carefully weigh all alternatives.
- I usually continue to search for a product until it reaches my expectations.
- When shopping, I plan on spending a lot of time looking for something.
- I find myself going to many different stores before finding the thing I want.
- When I see something that I want, I always try to find the best deal before purchasing it.

**HIGH STANDARDS**

(Min: 1.00, max: 7.00; source: Misuraca et al., 2015)

- In my work, I always set the highest goals for myself.
- No matter what I do, I always set the highest standards for myself.
- I never settle for a second-best solution.
- I am only satisfied when I have reached the highest goals.
- No matter how satisfied I am with the results of my work, I always aim to achieve even higher goals.

**NPD SPEED**

(Min: 1.00, max: 7.00; source: Sheng et al., 2013)

- Over the past three years, the speed of new product development of our firm is far ahead of our project timeline.
- Over the past three years, the speed of new product development of our firm is much faster than the industry norm.
- Over the past three years, the speed of new product development of our firm is much faster than we expected.
- Over the past three years, the speed of new product development of our firm is much faster than our typical product development time.

**NPD INNOVATIVENESS**

(Min: 1.00, max: 7.00; source: Sheng et al., 2013)

- Our products always incorporate state-of-the-art technologies.
- Most of our products involve major technological changes to an existing product.
- The technologies our firm's product incorporates are really out of the ordinary.
- The technologies in our products are quite new to our industry.
- The technologies incorporated in our new products always offer dramatic improvements in existing product features.

**PERFORMANCE**

(Min: 1.00, max: 7.00; source: Arend et al., 2016)

- Profitability relative to peers.
- Profitability relative to objectives.
- Growth relative to peers.
- Growth relative to objectives.

reflected in alternative search. Simple rules are organizationally shared heuristics for specific strategic processes (Bingham and Eisenhardt, 2011) and are also unlikely to be captured by alternative search, given that the scale asks for individual differences in

decision-making. More specifically, alternative search measures the general tendency to use fast-and-frugal heuristics but does not ask respondents which specific fast-and-frugal heuristics they employ. Thus, the scale aligns well with our conceptual focus on the general use of heuristics as a dimension of CEOs' decision style and complements prior work focused on the rationality of specific fast-and-frugal heuristics (e.g., Gigerenzer and Goldstein, 2011).

Alternative search captures a distinct dimension of decision-making behaviour since it has only modest correlations with other styles, such as avoidant (Dalal et al., 2015; Mikkelsen and Ray, 2020; Weinhardt et al., 2012), intuitive (Mikkelsen and Ray, 2020) or analytical (Turner et al., 2012) decision-making. Modest correlations are common even for distinct styles (see, for example, the five classic styles developed by Scott and Bruce, 1995). To make it simpler to interpret, we invert the alternative search scale: Higher scores indicate more use of heuristics, and lower scores indicate less use of heuristics. Cronbach's alpha for the scale was 0.73.

*CEO decision style: Decision standards.* We operationalized decision standards with the high standards scale developed by Misuraca et al. (2015), which captures time-stable differences in decision standards as part of individuals' decision styles. Higher scores indicate higher decision standards. This scale exhibited a Cronbach's alpha of 0.88.

*NPD speed and innovativeness.* We adopted the scales used by Sheng et al. (2013) to measure both NPD speed and NPD innovativeness. Consistent with prior work (e.g., Chandy and Tellis, 1998; McDonough and Barczak, 1991), these scales ask respondents to rate NPD speed over a specific time (in our case, three years) and NPD innovativeness as a constant; this is because NPD speed fluctuates over time (Griffin, 1996) while NPD innovativeness reflects a more fundamental strategic choice with less time-induced variation (Siguaw et al., 2006). Both scales had Cronbach's alphas of 0.90.

*Firm performance.* We measured firm performance as growth in sales and profits relative to competitors and to the respondents' goals (Arend et al., 2016). This scale had a Cronbach's alpha of 0.80. We used a primary measure since small firms in Germany are not legally required to publish financial performance data and because subjective performance assessments from executives correlate strongly with objective measures (Dess and Robins, 1984; Robinson and Pearce, 1988).

*Controls.* CEOs' demographic characteristics, such as age (Barker and Mueller, 2002), education (Lin et al., 2011; Wally and Baum, 1994), gender (Dezsö and Ross, 2012), and founder status (Lee et al., 2020) may influence NPD. Thus, we control for respondents' age (in years), education (university = 0, non-university = 1), gender (male = 0, female = 1), and founder status (founder = 0, non-founder = 1). We also control for CEO status (CEO = 0, Managing Director = 1) to rule out the possibility that respondents in formal CEO positions may have a stronger influence on NPD.

Firm age and size can also influence NPD activities (e.g., Coad et al., 2016; Hansen, 1992). Consequently, we include firm age (in years) and firm size (number of employees) as controls. In addition, higher decision standards may lead CEOs to self-select

into firms with higher technological ambition. We control for this possible behaviour by asking all respondents to classify their firms as low- or high-technology and including this variable in our empirical model (low-tech = 0, high-tech = 1). We also control for R&D expenses. More than 10 per cent of the observations for this control were missing, which could bias our results (Hair et al., 2010). Thus, we replace missing values with the sample mean. Finally, we also account for the influence of our control variables on our independent variables; removing these relationships does not substantially change our results.

### **Data Reduction, Common Method Variance, and Single Informant Bias**

*Confirmatory factor analysis (CFA).* Our proposed five-factor model showed good measures of fit for complex models in large samples (Hair et al., 2010):  $\chi^2[220] = 1171.809$ ,  $p < 0.001$ , CFI: 0.92, RMSEA: 0.06, SRMR: 0.05. All factor loadings were significant at the 0.1 per cent level, and all variables fulfilled the Fornell and Larcker (1981) criterion. We tested several alternative model specifications. First, we combined our two independent variables into one factor ( $\chi^2[224] = 1987.150$ ,  $p < 0.001$ , CFI: 0.85, RMSEA: 0.09, SRMR: 0.08). Then, we tested a model combining our two mediators ( $\chi^2[224] = 3232.288$ ,  $p < 0.001$ , CFI: 0.75, RMSEA: 0.11, SRMR: 0.09). Next, we tested a model combining both our independent variables into one factor and both our mediators into one factor ( $\chi^2[227] = 4045.130$ ,  $p < 0.001$ , CFI: 0.68, RMSEA: 0.13, SRMR: 0.11). Lastly, we specified a model in which all items loaded on the same factor ( $\chi^2[230] = 7941.207$ ,  $p < 0.001$ , CFI: 0.35, RMSEA: 0.18, SRMR: 0.17). Our theoretically derived, five-factor model fit the data markedly better than the other models.

*Common method variance.* We obtained our variables using survey measures, which may introduce common method variance (CMV) (Podsakoff et al., 2003). To limit the occurrence of CMV, we separated independent and dependent variables to mask interest in the relationships of interest, guaranteed confidentiality to all respondents, and used neutral descriptions in all scales (Podsakoff et al., 2012). After collecting the survey data, we tested for CMV using the comprehensive CFA marker technique (Williams et al., 2010) by adding a marker variable from our survey to the baseline CFA model and comparing this model to one in which all substantive items also loaded on the marker variable. We found no statistical difference between the two models ( $\Delta\chi^2 = 0.05$ ,  $df = 1$ ,  $p = 0.83$ ), bolstering our confidence that CMV does not influence our data (see Table AI for full results).

*Single informant bias.* To ensure that the assessments we gathered from our respondents were reliable, we contacted all our respondents again in September 2019, asking for a response from a second executive. We received 347 second responses. We dropped respondents who were not top management team members (69), did not indicate their position (45), or had missing values for our constructs (1), resulting in a final sample of 232 second respondents. We calculated intra-class correlation coefficients, comparing how the first and second respondents assessed our variables. Our performance measure exhibited good intra-class correlation (0.70), as did our measures for NPD innovativeness



(0.74) (Cicchetti, 1994; Cicchetti and Sparrow, 1981). Our NPD speed measure had an intra-class correlation of 0.57, slightly below the threshold of 0.6 but still fair (for full results, see Table AII). These intraclass correlations likely understate the true agreement between the first and second respondents since eight months had passed between the two data collections.

## RESULTS

### Descriptive and Univariate Analysis

We employed structural equation modelling (SEM) in SPSS AMOS 25 to analyse our data. SEM simultaneously estimates interrelationships between multiple variables and is thus suitable for our mediation model. Using our CFA model, we imputed factor scores for our variables, and we present descriptive statistics and correlations in Table II.

We tested for multicollinearity by conducting separate regressions for each predicted variable and computing variance inflation factors (VIFs). We observed no multicollinearity indicators, as the highest VIF (1.2) was well below accepted thresholds (Hair et al., 2010). Next, we proceeded to hypothesis testing, the results of which we summarize in Figure 2. We also included the direct relationships between our independent variables and firm performance, as is common in mediation models (Preacher et al., 2007).

### Direct Effects

Figure 2 shows that CEOs' use of heuristics, as measured by alternative search, has a statistically significant, positive relationship with NPD speed ( $\beta = 0.27$ ,  $p = 0.01$ ) but does not have a statistically significant association with NPD innovativeness ( $\beta = 0.15$ ,  $p = 0.13$ ). Meanwhile, CEOs' decision standards have a statistically significant, positive relationship with both NPD speed ( $\beta = 0.31$ ,  $p = 0.00$ ) and NPD innovativeness ( $\beta = 0.30$ ,  $p = 0.00$ ). The association between NPD speed and firm performance is statistically significant and positive ( $\beta = 0.16$ ,  $p = 0.00$ ), while that between NPD innovativeness and firm performance is not statistically significant ( $\beta = 0.00$ ,  $p = 0.65$ ). Finally, CEOs' decision standards also have a statistically significant, negative relationship with our proxy for CEOs' use of heuristics ( $\beta = -0.17$ ,  $p = 0.00$ ).

### Mediation by NPD Speed and NPD Innovativeness

We tested for mediation by calculating indirect effects based on the bootstrapping approach recommended by Preacher et al. (2007) and present the results in Table III. The association between our proxy for CEOs' use of heuristics and firm performance via NPD speed is statistically significant and positive ( $\beta = 0.04$ ,  $p = 0.02$ ), while their association via NPD innovativeness is not significant ( $\beta = 0.00$ ,  $p = 0.45$ ). These results support Hypothesis 1 but not Hypothesis 2.

Table II. Descriptive statistics

Variables	1	2	3	4	5	6	7	8	9	10	11	12
<i>CEO-Level Variables</i>												
1. CEO Decision Style: Use of Heuristics <sup>a</sup>	<b>0.60</b>											
2. CEO Decision Style: Decision Standards	-0.37***	<b>0.77</b>										
3. Age	0.02	-0.11***	-									
4. Education	-0.11***	0.09***	0.01	-								
5. Founder Status	-0.03	0.02	-0.19***	-0.04	-							
6. Gender	0.00	0.09***	-0.09***	0.00	0.06**	-						
7. CEO status	0.04	-0.04	0.01	-0.08***	-0.16***	-0.08***	-					
<i>Firm-Level Variables</i>												
8. NPD Speed	0.03	0.18***	-0.03	-0.01	0.01	-0.05	0.08**	<b>0.83</b>				
9. NPD Innovativeness	-0.02	0.20***	-0.07**	-0.07**	0.08	-0.12***	0.07**	0.45***	<b>0.80</b>			
10. Performance	-0.01	0.16***	0.00	0.09***	-0.03	-0.01	-0.01	0.42***	0.15***	<b>0.70</b>		
11. Age	0.06	-0.09***	0.11***	-0.03	0.00	0.02	-0.02	-0.05	-0.07**	-0.06	-	
12. High-tech/Low-tech	-0.01	0.03	0.00	-0.09***	-0.04	-0.16***	0.04	0.14***	0.41***	0.01	-0.03	-
13. Size	0.06	-0.05	0.02	0.04	0.06	-0.06	0.02	0.03	0.01	0.11***	-0.01	-0.02
<i>Statistics</i>												
Mean	4.0	5.0	47.3	0.7	0.1	0.1	0.7	2.8	4.3	4.5	8.6	14.4
SD	1.0	1.2	9.1	0.5	0.3	0.3	0.4	1.2	1.6	1.0	1.6	30.1
CR	0.74	0.88	-	-	-	-	-	0.83	0.90	0.72	-	-

Note: N = 1046. Bolded values on the diagonal show the square root of average variance extracted (AVE).  
 Abbreviations: CR, Composite Reliability; SD, Standard Deviation.  
<sup>a</sup>As measured by alternative search.  
 \*\*p < 0.05; \*\*\*p < 0.01.

**Results of Structural Equation Modeling**

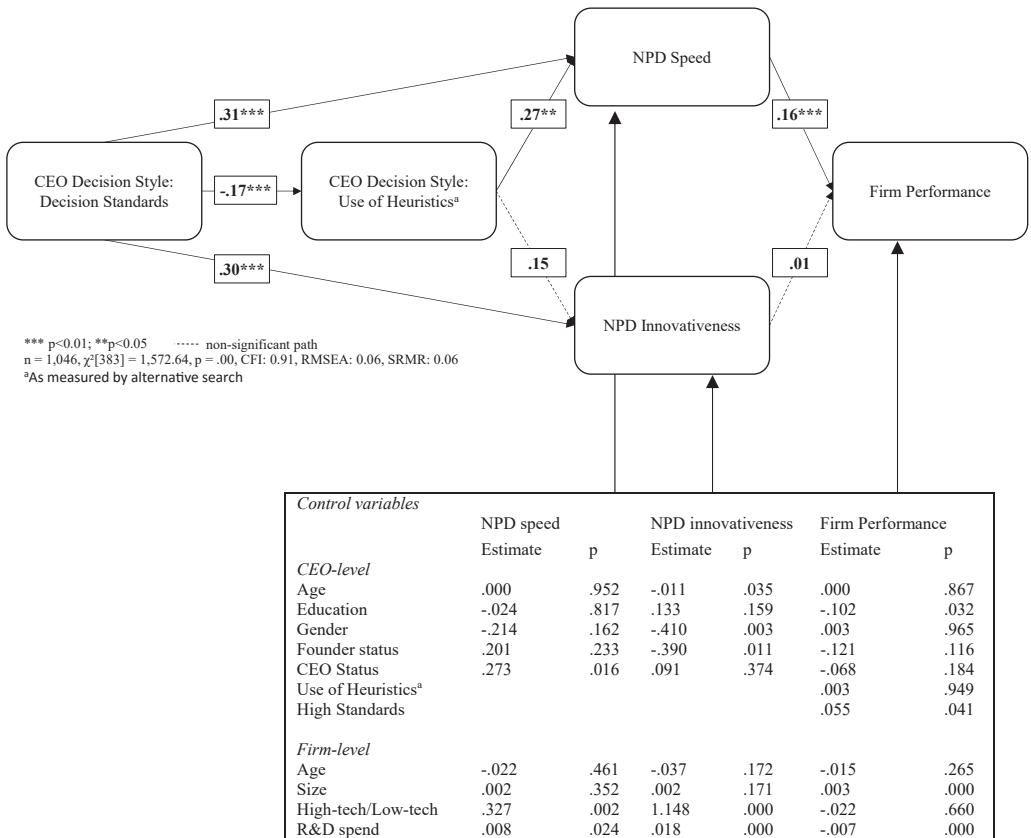


Figure 2. Results of structural equation modelling

CEO decision standards have a statistically significant and positive association with firm performance via NPD speed ( $\beta = 0.05, p = 0.00$ ). In contrast, CEO decision standards do not have a statistically significant association with firm performance via NPD innovativeness ( $\beta = 0.00, p = 0.62$ ). These findings support Hypothesis 3 but not Hypothesis 4.

In addition, the association between CEO decision standards and firm performance via our proxy for CEOs’ use of heuristics and via NPD speed is statistically significant and negative ( $\beta = -0.01, p = 0.02$ ), while the association between CEO decision standards and firm performance via our proxy for CEOs’ use of heuristics and NPD innovativeness is not statistically significant ( $\beta = 0.00, p = 0.44$ ). These results support Hypothesis 5 but not Hypothesis 6.

**Supplemental Analyses**

We conducted multiple regression analyses to test the robustness of our findings (for full results, see Table AIII). The direct effects of our two independent variables are similar

Table III. Indirect effects and bootstrapping results (dependent variable: firm performance, SEM model)

<i>Hypothesis</i>	<i>Independent Variable (CEO Decision Style)</i>	<i>Mediators</i>	<i>Indirect Effect</i>	<i>p</i>	<i>95% Bootstrapped Conf. Interv.</i>	
					<i>Lower</i>	<i>Upper</i>
Hypothesis 1	Use of Heuristics <sup>a</sup>	NPD Speed	0.04	0.02	0.01	0.09
Hypothesis 2	Use of Heuristics <sup>a</sup>	NPD Innovativeness	0.00	0.45	-0.00	0.01
Hypothesis 3	High Standards	NPD Speed	0.05	0.00	0.03	0.08
Hypothesis 4	High Standards	NPD Innovativeness	0.00	0.62	-0.01	0.02
Hypothesis 5	High Standards	Use of Heuristics <sup>a</sup> -> NPD Speed	-0.01	0.02	-0.02	-0.00
Hypothesis 6	High Standards	Use of Heuristics <sup>a</sup> -> NPD Innovativeness	0.00	0.44	-0.00	0.00

*Note:* Confidence intervals based on 5000 bootstrapped samples.

<sup>a</sup>As measured by alternative search.

Table IV. Indirect effects and bootstrapping results (dependent variable: firm performance, multiple regression)

<i>Hypothesis</i>	<i>Independent Variables (CEO Decision Style)</i>	<i>Mediators</i>	<i>Indirect Effect</i>	<i>p</i>	<i>95% Bootstrapped Conf. Interv.</i>	
					<i>Lower</i>	<i>Upper</i>
Hypothesis 1	Use of Heuristics <sup>a</sup>	NPD Speed	0.05	0.01	0.01	0.08
Hypothesis 2	Use of Heuristics <sup>a</sup>	NPD Innovativeness	-0.00	0.98	-0.01	0.00
Hypothesis 3	High Standards	NPD Speed	0.04	0.00	0.02	0.06
Hypothesis 4	High Standards	NPD Innovativeness	-0.00	0.44	-0.01	0.00
Hypothesis 5	High Standards	Use of Heuristics <sup>a</sup> -> NPD Speed	-0.01	0.01	-0.02	-0.00
Hypothesis 6	High Standards	Use of Heuristics <sup>a</sup> -> NPD Innovativeness	0.00	0.74	-0.00	0.00

*Note:* Confidence intervals based on 5000 bootstrapped samples.

<sup>a</sup>As measured by alternative search.

in magnitude, direction, and statistical significance to the effects observed in our SEM. The only notable difference is that the relationship between CEOs' use of heuristics, as measured by alternative search, and NPD innovativeness is now statistically significant in the direction of our Hypothesis 2 ( $\beta = 0.16$ ,  $p = 0.07$ ). We tested the robustness of our indirect effects using the bootstrapping and product-of-coefficients procedure for each hypothesized relationship individually in SPSS (Preacher et al., 2007) and present the results in Table IV. As in our SEM model, the results support Hypothesis 1, 3, and 5 but not Hypothesis 2, 4, or 6.

## DISCUSSION

### Theoretical Implications

This paper linked CEOs' decision styles to NPD speed, NPD innovativeness, and firm performance. We found that CEOs' use of heuristics and adoption of higher decision standards are associated with higher NPD speed and stronger firm performance (as proposed in Hypothesis 1 and 3). Higher CEO decision standards also appeared to reduce the use of heuristics, resulting in lower NPD speed and a negative relationship with firm performance (as proposed in Hypothesis 5). However, this effect is very small. Our results thus suggest that CEOs may benefit their firms by using more heuristics and adopting higher standards in decision-making. Contrary to our predictions in Hypothesis 2, 4, and 6, we found no evidence that a greater use of heuristics and higher decision standards are associated with increased performance through higher NPD innovativeness. This is mainly because NPD innovativeness has no statistically significant relationship with firm performance in our sample; we will return to this finding below.

On an overarching level, our study highlights the importance of CEO decision styles as a determinant of firm performance and NPD, thus extending prior work on CEOs' demographics and personalities as predictors of firm-level and NPD outcomes (for reviews, see Back and Bausch, 2019; Wang et al., 2016). We also provide four distinct contributions to the literature on managerial decision-making. The first is the insight that heuristics may be effective decision tools for CEOs. Fast-and-frugal scholars have examined the ecological rationality of specific heuristics for single choices (Gigerenzer et al., 2022). Our findings, which suggest a positive link between CEOs' use of heuristics and higher firm performance, extend this work by indicating that CEOs' general use of heuristics may be ecologically rational, i.e., effective. We thereby answer research calls for more generalizable evidence that heuristics can provide value to organizations (Loock and Hinnen, 2015; Luan et al., 2019). Our findings also challenge the prevailing view of heuristics in the management literature as biased and ineffective decision strategies (Dean and Sharfman, 1993; Kahneman, 2003) and cast doubt on the normative ideal of systematic and thorough decision-making for managers (Cabantous and Gond, 2011; Samba et al., 2021). In sum, we contribute to efforts to present a more positive view of heuristics in management (Artinger et al., 2015; Bingham and Eisenhardt, 2011).

Second, we also shed light on *how* CEOs' use of heuristics may benefit firms. Heuristics-and-biases and fast-and-frugal scholars agree that using heuristics enables fast, individual decisions. We add to this work by showing that using heuristics may also result in accelerated organizational processes (faster NPD speed), which improve overall firm performance. By proposing faster organizational processes as a causal mechanism through which heuristics improve firm performance, we answer research calls for a better understanding of the channels through which heuristics provide value to firms and to substantiate empirically whether heuristics are associated with faster firm-level processes (Loock and Hinnen, 2015, p. 2034). Moreover, prior work in management research has argued that heuristics lead to a trade-off between decision speed and effectiveness (Samba et al., 2021). Our findings question the existence of such a trade-off since the use

of heuristics appeared to enhance NPD speed without diminishing NPD innovativeness. Instead, our findings support the theoretical position of fast-and-frugal scholars, who argue that heuristics can improve decision speed without sacrificing decision effectiveness in uncertain decision environments, such as most management contexts (Artinger et al., 2015).

Our third contribution is the insight that differences in CEOs' decision standards may be an understudied determinant of organizational performance. Prior management studies implicitly assume that all managers have equally high standards (Dean and Sharfman, 1993; Jensen and Meckling, 1994). We extend this work by theorizing that differences in CEOs' decision standards are substantial and may influence organizational effectiveness. Our finding of a positive relationship between decision standards and firm performance supports these arguments. Thus, we question the assumption of uniformly high decision standards among managers and contribute to developing more realistic and comprehensive models of managerial decision-making (e.g., Foss, 2020; Hambrick and Crossland, 2018; Powell et al., 2011).

Fourth, we provide novel insights into how decision standards may shape organizational effectiveness. Fast-and-frugal scholars have considered decision standards solely as triggers for information search (Gigerenzer and Gaissmaier, 2011; Luan et al., 2014). We extend this work by linking decision standards directly to NPD outcomes through changes in risk preferences. Our empirical results, showing a positive relationship between decision standards, NPD speed, and NPD innovativeness, support these arguments. Thus, we call attention to an underexplored theoretical mechanism through which decision standards affect decision outcomes, the inclusion of which may further refine models of managerial decision-making.

Contrary to expectations, we found no significant relationship between NPD innovativeness and firm performance. Prior work suggests that innovative products increase firm performance by creating product advantage (McNally et al., 2010) but also reduce firm performance by necessitating changes in organizational structures, capabilities, and external networks (Kock et al., 2011). Perhaps these positive and negative effects of NPD innovativeness cancel each other out, resulting in a nonsignificant relationship with performance.

### **Practical Implications**

Our results indicate that CEO decision styles that incorporate a stronger reliance on heuristics and higher decision standards may enhance NPD outcomes and overall organizational effectiveness. While decision styles are generally time-stable (Dalal et al., 2015), prior work suggests it may be possible to adapt them over time, for example, through coaching (Kidman et al., 2001). Our study thus indicates that CEOs may become more effective leaders of their firms by adapting their decision styles. We also illuminate which dimensions of CEOs' decision styles may most effectively produce specific outcomes for firms. If heuristics indeed accelerate organizational processes, it may be most effective for CEOs to use them when their firms engage in time-based competition (Stalk, 1988). Higher standards appear to be equally valuable for firms in time-based competition and for those using a differentiation strategy (Porter, 1980)

since we found higher decision standards to be associated with higher NPD speed and higher NPD innovativeness.

### **Limitations and Future Research**

Our study has several limitations that offer avenues for future research. First, we used self-reported measures and relied on single respondents for our main analysis. Even though we conducted tests for common method bias and collected additional data from second respondents, we cannot rule out the possibility that common method bias influenced our results. Thus, a worthwhile endeavour would be to link CEOs' decision styles with organizational outcomes using mixed-method approaches that overcome this limitation. For instance, future research could create measures for decision styles based on secondary data, which may then be linked to objective performance indicators.

Second, we conceptualized and measured the use of heuristics along a unidimensional continuum of decision-making, which is consistent with prior work in fast-and-frugal heuristics (Kruglanski and Gigerenzer, 2011). However, a wide range of decision-making scholars argue that two distinct types of information processing systems exist, which cannot be aggregated into one continuum (for a recent review, see Hodgkinson and Sadler-Smith, 2018). Thus, the validity and interpretability of our results are contingent on the validity of the unidimensional model. There is therefore an opportunity for future work on CEOs' decision styles grounded in dual-processing theories.

Third, we theorized about the mechanisms through which CEO decision styles affect NPD outcomes but did not observe these mechanisms empirically. Future work may zoom in on these relationships and examine our proposed mechanisms explicitly. For instance, scholars may use qualitative methods to substantiate the link between CEOs' use of heuristics, the implementation of simple rules, and NPD outcomes.

Fourth, the relationship between CEO decision style and NPD outcomes may be driven by omitted variables. For example, CEOs may recruit middle managers with decision styles similar to their own, and these middle managers may influence NPD outcomes. Alternatively, decision styles (e.g., higher standards) may be associated with a stronger tendency among CEOs to centralize decision-making, which may, in turn, affect NPD speed and innovativeness. If these alternative explanations are accurate, the main implications of our study would remain intact, but NPD outcomes and firm performance would be driven by different theoretical mechanisms than those we proposed. Since our research design does not allow us to rule out alternative causal mechanisms, an opportunity exists for future research to explicitly model and test different theoretical mechanisms relating CEO decision styles to NPD outcomes. For example, multi-level methods could serve to study the relationship between CEOs' decision styles, hiring decisions, and NPD outcomes.

Fifth, even though CEOs' use of heuristics appears to be associated with stronger firm performance, this does not imply that CEOs should abandon systematic and thorough decision-making. A wide range of decision strategies can be effective in different settings (Todd et al., 2000) and decision environments likely exist in which more complex

decision-making is effective. Future research may study decision styles in different environments, such as finance or marketing.

Sixth, we tested our predictions in young firms. Thus, our findings may not generalize to larger and older ones with established structures that may restrain the influence of CEOs. Most of our sample CEOs were also founders, and CEOs in larger firms are mostly professional managers with less influence on their firms than founders. More research is needed to explore CEOs' decision styles in larger and more mature firms.

Finally, our empirical model did not test for causal relationships but focused on associations. While it appears reasonable that CEO decision-making influences NPD outcomes and performance and not vice versa, future work may use longitudinal or experimental designs to validate the causal relationship between decision styles and organizational outcomes.

## CONCLUSION

This study theorized links between CEOs' decision styles, NPD outcomes, and firm performance. Our results suggest that the use of more heuristics and the adoption of higher decision standards among CEOs may be related to higher firm performance by promoting NPD speed. We hope our study encourages future research on the organizational consequences of decision styles.

## ACKNOWLEDGEMENTS

Open Access funding enabled and organized by Projekt DEAL.

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## APPENDIX

Table AI. Model fit indices and model comparison for CFA models with marker variable

Model	$\chi^2$ (df)	CFI	RMSEA (90% CI)	LR of $\Delta\chi^2$	Model comparison
CFA with marker	1388.47 (335)	0.93	0.055 (0.052–0.058)		
Baseline	1395.84 (350)	0.92	0.054 (0.051–0.057)		
Method-C	1395.79 (349)	0.92	0.054 (0.051–0.057)	0.05, $df = 1$ , $p = 0.83$	vs. Baseline
Method-U	1369.16 (327)	0.92	0.056 (0.053–0.059)	26.63, $df = 22$ , $p = 0.23$	vs. Method-C

Abbreviations: C, common; CFA, confirmatory factor analysis; CFI, comparative fit index; LR, likelihood ratio test; RMSEA, root mean square error of approximation; U, unconstrained.

Table AII. Comparison of first and second respondents

	<i>Mean First Respondent</i>	<i>Mean Second Respondent</i>	<i>Intra-Class Correlation<sup>a</sup></i>	<i>95% Confidence Interval</i>	
				<i>Lower</i>	<i>Upper</i>
NPD Speed	4.03	3.82	0.57	0.44	0.66
NPD Innovativeness	4.36	4.38	0.74	0.66	0.80
Firm Performance	4.56	4.34	0.70	0.61	0.77

<sup>a</sup>Two-way mixed, absolute agreement, n = 232.

Table AIII. Multiple regression analysis

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
	<i>CEO Decision Style: Use of Heuristics<sup>a</sup></i>	<i>NPD Speed</i>	<i>NPD Innovativeness</i>	<i>Firm Performance</i>
<i>Control variables</i>				
<i>CEO-level</i>				
Age	-0.00	0.00	-0.01**	0.00
Education	-0.08***	0.02	-0.12	0.08**
Gender	0.06	-0.20	-0.36***	0.00
Founder Status	-0.05	0.16	-0.34**	-0.10
CEO Status	0.03	0.24**	0.09	-0.05
<i>Firm-level</i>				
Firm Age	0.01	-0.02	-0.03	-0.01
Firm Size	0.00	0.00	0.00	0.00***
High-tech/Low-tech	0.01	0.34***	1.03***	-0.01
R&D Spend	-0.00	0.01**	0.02***	-0.01***
<i>Independent Variables</i>				
CEO Decision Style: High Standards	-0.19***	0.34***	0.32***	0.06***
CEOs Decision Style: Use of Heuristics <sup>a</sup>		0.33***	0.16*	0.01
NPD Speed				0.18***
NPD Innovativeness				-0.01
R <sup>2</sup>	0.15	0.08	0.25	0.22
F	17.85***	7.84***	30.54***	22.02***

Note: N = 1046.

<sup>a</sup>As measured by alternative search.

\*p < 0.10; \*\*p < 0.05; \*\*\*p < 0.01.