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**What predicts effectuation preferences? Disentangling individual and environmental factors and illuminating decision criteria**

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## What predicts effectuation preferences? Disentangling individual and environmental factors and illuminating decision criteria

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**Abstract:** Effectuation, a logic for entrepreneurial decision-making, has been suggested to be predominantly used by entrepreneurs and specifically appropriate in entrepreneurial environments. This study challenges previous assumptions in effectuation literature by exploring whether it is the: a) entrepreneurial experience or b) entrepreneurial environment that determines individuals' preferences for effectuation over causation. Our experimental vignette study suggests that being in an entrepreneurial environment but not the decision-makers' entrepreneurial experience predicts a preference for effectuation. In an additional qualitative analysis, we investigate which decision criteria drive these results. Moreover, we discuss our exploratory finding that more women than men seem to prefer effectuation. We elaborate on the implications of our findings for effectuation research and practice.

**Keywords:** effectuation; decision-making; entrepreneurial expertise; entrepreneurial environment; gender; experimental design; vignettes.

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## 1 Introduction

Sarasvathy (2001) introduced effectuation, contrasted to causation, to describe an entrepreneurial way of decision-making. To explain why entrepreneurs rely on effectuation, previous research suggested individual as well as environmental factors. Effectuation has been described as ‘an entrepreneurial expertise that can be acquired with time and deliberate practice’ (Read and Sarasvathy, 2005, p.45). If effectuation is an expertise, learned during entrepreneurial activity, individuals may develop preferences for effectuation as they develop entrepreneurial expertise. During entrepreneurial activity, they learn how to apply the logics of effectuation and in what way they are beneficial such that their entrepreneurial experience increases their understanding of the value of effectuation and their ability to apply effectuation. Accordingly, entrepreneurial experience, as an individual level factor, might be a predictor of effectuation preferences. Several empirical studies provide support for this notion (e.g., Engel et al., 2014).

However, besides entrepreneurial experience, environmental factors have been suggested to predict whether individuals rely on effectual or causal logics (Laine and Galkina, 2017; Nelson and Lima, 2020; Perry et al., 2012; Wu et al., 2020). Effectuation was developed in the context of starting a new business, and appears particularly useful in environments that are characterised by resource constraints and/or high uncertainty (Read et al., 2001; 2008; Wiltbank et al., 2009; Wu et al., 2020). We refer to those environments, in which effectuation is considered to be particularly appropriate, as ‘entrepreneurial environments’.

Still, whether the entrepreneurial environment makes effectuation appropriate and necessary or whether individual entrepreneurial experience or predispositions make people understand, prefer and use effectual logics, remains unclear. Although entrepreneurs have been shown to apply other logics than managers (Busenitz and Barney, 1997; McCarthy et al., 1993; Dew et al., 2009), most previous empirical studies do not disentangle whether it is entrepreneurs who ‘think differently’, i.e., prefer effectuation, or whether anybody would in an entrepreneurial environment ‘think entrepreneurially’, i.e., prefer effectuation. In addressing this question, our study challenges assumptions of effectuation literature, and advances the knowledge about mechanisms and decision criteria in entrepreneurial decision-making.

We argue that entrepreneurs’ entrepreneurial expertise, containing the ability to apply effectuation logics, makes them realise effectuation’s potential – not only in

environments of high uncertainty and in situations in which they are starting a new business but across different environments. Thus, we argue that individuals' effectuation preferences could increase with their entrepreneurial experience such that those with entrepreneurial experience are likely to have higher preferences for effectuation than those without entrepreneurial experience, across different environments. In a parallel vein, we also argue that, because effectuation has been suggested to be particularly suitable in entrepreneurial environments, individuals may perceive, in an entrepreneurial environment, that effectuation is more appropriate than causation, whether or not they have entrepreneurial experience.

Therefore, our study analyses whether individual or environmental factors influence individuals' decisions for effectuation vs. causation. We employ a vignette study in which participants make a decision for effectuation vs. causation in an entrepreneurial environment vs. an established firm environment. Specifically, participants are asked to imagine they are

- 1 founders starting a new business and their situation is characterised by resource constraints and uncertainty (entrepreneurial environment)
- 2 managers in an established firm and their situation is characterised by abundant resources and stability (established environment).

In each situation, participants make a decision between two projects, one described based on the logics of causation, the other on the logics of effectuation (Brettel et al., 2012). In an extensive pre-study, we developed and tested the project descriptions that represent causation and effectuation logics. In the main study, we recruited a sample of entrepreneurs and non-entrepreneurs (i.e., employees), to allow for an analysis of differences due to entrepreneurial experience. We quantitatively analysed participants' decisions, and qualitatively analysed their reasoning for a decision, which they wrote down after making the decision. In a next step, we extended the qualitative analysis with think-aloud protocols of the decision process of additional entrepreneur and non-entrepreneur participants, while they walk through the decision process in our experimental study.

This paper advances the literature on effectuation in several ways. First, addressing recent calls for research on the conditions under which either effectuation or causation is applied (Sirén et al., 2019; Read et al., 2016), our study provides a better understanding of the predictors of effectuation over causation. Drawing on previous research that suggested individual factors (e.g., referring to effectuation as an entrepreneurial expertise) and environmental factors (e.g., referring to effectuation being appropriate in uncertain environments) as predictors of effectuation, we investigate whether effectuation is applied because the entrepreneurial environment makes effectuation appear appropriate (to anyone) or whether experienced entrepreneurs have learned to value and apply effectuation (and would apply effectuation in any environment).

Second, we analyse which perceptions and interpretations account for choosing effectuation or causation which provides a nuanced understanding of the decision criteria and the decision process when weighing effectuation vs. causation. Our findings go beyond previous theorising by suggesting that each effectuation dimension evokes distinct interpretations. For instance, our results indicate that individuals choosing effectuation do so because they perceive it as lower risk or less cost intensive than causation, and because they perceive using the means at hand to be beneficial. Causation,

in contrast, appears to be chosen because it is perceived more promising than effectuation and because developing a competitive advantage is seen important. Interestingly, building partnerships, which is part of the effectuation choice, was interpreted positively (cooperation) or negatively (lost independence), even in the same kind of decision situation. Additionally, our research provides a new perspective as we discuss in what way our exploratory finding that women seem to be more likely than men to prefer effectuation are in line with role congruity theory and stereotypes research. Thereby, our study contributes to the vibrant discussion about predictors of individual entrepreneurial behaviour (e.g., Covin et al., 2020; Sirén et al., 2019).

Third, by designing a vignette study, we introduce a new and particularly controlled approach for studying effectuation preferences. Previous research on predictors of effectuation primarily used explorative qualitative methods, theoretical reasoning, or controversially discussed quantitative measures; with only few recent exceptions. Manipulating environmental differences allows us to account for methodological problems that occurred in many previous studies on effectuation (Perry et al., 2012). For example, in our experimental approach, individual and environmental factors are disentangled, while they had been inherently intertwined in many previous studies (Arend et al., 2015). Additionally, in previous studies, uncertainty was mostly measured by entrepreneurs' perceptions (Perry et al., 2012). These perceptions are intertwined with preferences for effectuation because individuals who use effectuation perceive risk and uncertainty, and possibilities to apply effectuation, differently (Parida et al., 2016; Sarasvathy, 2001). Our experimental study design is able to show effects which are independent from these perceptual differences.

In the following, we first introduce the logics of effectuation, and the current state of effectuation research. Next, we discuss in what way individuals' entrepreneurial experience and the characteristics of a situation determine preferences for effectuation or causation, and develop hypotheses which we test in our vignette study. Building on our qualitative analysis, we then discuss the decision-making process in more detail.

## **2 Theoretical background**

### *2.1 Causation and effectuation*

Causal decision models always were and will probably stay an important part of business life. Abundant studies showed the value of causation based strategic planning in established firms (Miller and Cardinal, 1994; Schwenk and Shrader, 1993). Especially decision-making based on the collection and analysis of environmental information appears to be an appropriate procedure, at least if decision-makers belief in a sufficiently stable and predictable future (Sarasvathy, 2001). Causation also forms the basis for several useful tools and procedures which support business decisions (Smolka et al., 2018). Thus, the causal approach also is an essential part of business studies and research for potential future entrepreneurs (Dew et al., 2009; Perry et al., 2012; Read and Sarasvathy, 2005). Therefore, the rational decision models, at least in an adapted fashion, play a significant role also in the entrepreneurial context (Fisher, 2012; Perry et al., 2012).

However, it is less clear whether extensive business planning benefits performance of entrepreneurs (Burke et al., 2010; Chwolka and Raith, 2012; Delmar and Shane, 2003;

Gruber, 2007; Honig and Samuelsson, 2014; Lerner et al., 2018). Busenitz and Barney (1997) found that, under conditions of environmental uncertainty and complexity, heuristics can be an effective and efficient guide to decision-making. Despite the positive relationship between planning and venture performance (Mayer-Haug et al., 2013), more and more evidence also suggests a positive relationship between the use of effectuation and venture performance (Cai et al., 2017; Read et al., 2009). Effectuation is a specific way of decision-making (Sarasvathy, 2001). Effectuation is suggested to be employed by entrepreneurs, and to be appropriate in entrepreneurial environments. Effectuation is considered to be applicable on individual as well as firm level (Werhahn et al., 2015), and is seen as an interesting and realistic approach (Landström and Harirchi, 2019). Effectuation as originally described as an entrepreneurial expertise that develops over time during entrepreneurial activity. Recent research argues that it also has relevance for innovation in established firms (Henniger et al., 2020; Szambelan et al., 2020) and that it can be taught in the classroom (Zhu et al., 2021). Thus, both approaches, effectuation and causation, are part of the human thinking process and seem to have merit.

To contrast effectuation and causation, we draw on four principles that have been used to describe the core of the effectuation logic (Sarasvathy, 2001, 2008).

- 1 *Affordable loss vs. expected returns*: While the causal approach focuses on maximisation of expected returns and aims at pursuing the optimal strategy, the effectual approach focuses on minimising risk considering the maximum loss affordable. Effectuation pursues as many strategies as possible with the given and limited means.
- 2 *Strategic alliances vs. competitive analyses*: While causation models analyse the market in order to better react to competitive firms, effectuation models build strategic alliances to reduce uncertainty.
- 3 *Exploitation of contingencies vs. exploitation of preexisting knowledge*: While causation focuses on using preexisting knowledge and resources as a competitive advantage, effectuation focuses on exploiting unexpected contingencies as a positive way to develop in different directions.
- 4 *Controlling an unpredictable future vs. predicting it*: While causation processes try to predict the future to avoid unexpected contingencies, effectuation processes instead try to control the unpredictable future. (Read et al., 2009; Sarasvathy, 2001, 2008).

Since effectuation's establishment, several studies analysed its nature and impact (e.g., Brettel et al., 2012; Hubner and Baum, 2018; Sullivan Mort et al., 2012; Smolka et al., 2018; Reymen et al., 2015; An et al., 2020). However, investigations of antecedents of preferences for causation or effectuation have been intensified just recently. These studies found an influence of prior experiences e.g., management and entrepreneurial experience foster experimentation (Frese et al., 2020), and work and founding experience shape risk and prediction orientation (Markowska et al., 2019). Schmidt and Heidenreich (2018) found corporate entrepreneurship experience relates to causation rather than effectuation.

Moreover, there is some evidence for an influence of perceptions of the environment, like its dynamism (Markowska et al., 2019), controllability (Parida et al., 2016) or uncertainty (Frese et al., 2020). Additionally studied predictors on other levels include investor influence (Frese et al., 2020), the relational context of the team (Tryba and Fletcher, 2020), national culture (Laskovaia and Shirokova, 2017), project stages

(Anagnou et al., 2019; Becker et al., 2015), and career motives (Gabrielsson and Politis, 2011). Influence mechanisms also are not stable but seem to vary, the influence of experience seems to be stronger in early than the later stages of venture development (Frese et al., 2020), and the specific decision context (Anagnou et al., 2019; Hauser et al., 2020) as well as disruptive events (Nelson and Lima, 2020) can change whether or not a logic is applied.

Despite these insights, the nature and appropriateness of effectuation still is an issue of controversial discussions (Arend et al., 2015; Mansoori and Lackeus, 2020). Some authors describe the constructs as orthogonal (Perry et al., 2012; Dew et al., 2009; Fisher, 2012), others as inverse (Read and Sarasvathy, 2005), others as opposing (Brettel et al., 2012). Researchers developed measures which are based on different operationalisations of the effectuation construct: formative or reflective (Brettel et al., 2012; Chandler et al., 2011). Moreover, an evaluation of the particular processes that underlie each decision-making logic, and considerations of the circumstances of the decision, was neglected so far (Fisher, 2012; Read and Sarasvathy, 2005).

For these and other reasons, many researchers (e.g., Arend et al., 2015; Welter and Kim, 2018) have pointed out that effectuation falls short in several categories as a ‘full-fledged theory’, at the current point of study. Welter and Kim (2018) highlight additional work is necessary to clarify the boundary conditions of effectuation’s applicability. Arend et al. (2015) also state it is necessary to identify which behavioural fundamentals drive the observed patterns in order to justify why the actions described are specific to more expert entrepreneurs. They suggest a more detailed analysis would help to move from a rather tautological connection to a decoupled system, and would help to define the boundaries. Addressing those calls, our study aims to contribute to the shift of the effectuation literature from a nascent to a more advanced phase. At the current state of research, it remains unclear whether

- a the entrepreneurial environment makes effectuation appropriate and necessary or
- b individual experiences or predispositions make people understand, prefer and use effectuation.

## *2.2 Individual differences and effectuation preferences*

Several studies found entrepreneurs differ from managers in their use of specific heuristics, including effectuation (Busenitz and Barney, 1997; McCarthy et al., 1993; Dew et al., 2009). Sarasvathy (2008) introduced effectuation as entrepreneurial expertise suggesting that individuals learn over time, during entrepreneurial activity, how to navigate entrepreneurial environments, and that such entrepreneurial environments require specific decision-making logics. Nevertheless, as individuals are not randomly becoming entrepreneurs but self-select and are selected into entrepreneurial environments, also individual traits and predispositions could contribute to creating effectuation preferences in individuals who acquire entrepreneurial experience. Individual traits are likely to determine who selects and is selected into entrepreneurship, and that way also who develops entrepreneurial expertise, and in turn who may develop preferences for effectuation.

For example, individuals differ in tendency towards risky decisions because risky decisions are usually influenced by individual risk propensity and risk perceptions—rather than by a potentially calculated risk measure. Thus, the exact same decision situation

might be perceived highly uncertain or complex by one individual but not by another (Townsend et al., 2018). Also, whether individuals apply an expected return or affordable loss logic influences their risk perception and in turn their decision whether or not to invest (Sarasvathy, 2008). Moreover, individual differences, such as entrepreneurs' passion (Cannatelli et al., 2019) and aspirations (Liu, 2019), may influence whether they prefer effectuation or causation.

Nevertheless, Sarasvathy (2008) concludes preferences for effectuation will in any case converge and thus increase with entrepreneurial experience. Research seems to agree effectuation is an entrepreneurial expertise that can be acquired with time and deliberate practice, during acting in entrepreneurial environments (Read and Sarasvathy, 2005). Several studies, including Dew et al. (2009) and Schmidt and Heidenreich (2018), have provided the empirical support for the relation between entrepreneurial experience and effectuation.

Acting in entrepreneurial environments, and developing entrepreneurial experience, should increase individuals' ability to sense, act, and navigate under particular-entrepreneurial-conditions (Uygur and Kim, 2016). As decision-making logics emerge and develop in socialisation processes (Schwarz, 1998), individuals' preferences evolve over their life path and personal experiences (Sarasvathy, 2008). During acting in entrepreneurial environments, individuals live through a particular learning process (Honig and Hopp, 2019) and develop an 'entrepreneurial mindset' (Haynie et al., 2010; Ireland et al., 2003). They learn to deal with the dynamism and uncertainty inherent in entrepreneurial environments, which require constantly rethinking current behaviours, strategic actions, and decisions (Hitt et al., 1998; Haynie et al., 2010). Such experiences also help to develop entrepreneurial alertness, which Sirén et al. (2019) found to positively relate to effectuation. Schmidt and Heidenreich (2018) suggest that entrepreneurial experience helps to apply previous knowledge, specifically in an effectuation approach. They found that start-up experience relates to effectuation whereas corporate entrepreneurship experience relates to causation. Following the argument of Read and Sarasvathy (2005) who argue that effectuation is an entrepreneurial expertise, we argue that increased entrepreneurial experience should increase individuals' ability to understand effectuation's value and in turn their preference to apply effectuation.

Entrepreneurial experience should also increase entrepreneurial self-efficacy and confidence (Dimov, 2010), and those have been shown to be positively related to effectuation (Engel et al., 2014; Chen et al., 1998; Hmieleski and Baron, 2008), particularly when combined with harmonious passion or risk perceptions (Stroe et al., 2018). Entrepreneurial self-efficacy is the 'strength of one's confidence in the ability to perform entrepreneurial tasks' (Engel et al., 2014, p.3), and reinforces one's belief of being able to influence the environment (Busenitz and Barney, 1997; Wood and Bandura, 1989). The belief of being able to influence should be related to feelings of confidence, control, agency, and proactiveness, which relate to effectuation preferences (Engel et al., 2014; Szambelan et al., 2020). Therefore, we assume that with entrepreneurial experience increase confidence and entrepreneurial self-efficacy, and in turn effectuation preferences. Frese et al. (2020) provide empirical support for this argument showing prior experiences, i.e., management and entrepreneurial experience, foster experimentation, which is part of effectuation.

Accordingly, we expect that individuals who have experience as entrepreneurs, and thus should have the traits and pre-dispositions for entrepreneurship, and have high



entrepreneurial expertise and self-efficacy, are more likely to prefer effectuation over causation than individuals who do not have entrepreneurial experience.

*Hypothesis 1: Preferences for effectuation over causation are higher in individuals with entrepreneurial experience than in individuals without entrepreneurial experience.*

### 2.3 *Environmental factors and effectuation preferences*

Almost all effectuation literature refers to the entrepreneurial environment as predictor for effectuation preferences, at least in combination with individual factors (Sarasvathy, 2008). Effectuation is expected to be appropriate in an entrepreneurial environment and thus to be more likely to be applied in an entrepreneurial environment (Sarasvathy, 2001). Therefore, it is not yet clear whether experienced entrepreneurs have learned to value and apply effectuation, and would rely on effectuation in any environment (as argued above), or whether effectuation is applied because the entrepreneurial environment (e.g., uncertainty in the environment) makes effectuation appear appropriate (to anyone). Different aspects of the ‘entrepreneurial environment’ have been suggested to stimulate effectuation preferences:

First, entrepreneurial environments are repeatedly characterised by uncertainty (Busenitz, 1996; Gaglio and Katz, 2001; Russell and Russell, 1992; Townsend et al., 2018). Entrepreneurial action is often even defined as ‘behaviour in response to a judgemental decision under uncertainty about a possible opportunity for profit’ (McMullen and Shepherd, 2006, p.134). McMullen et al. (2007) even propose without uncertainty there is no opportunity at all. If then opportunity recognition, whether discovered or created, is a necessity to entrepreneurial action, uncertainty is as well (Edelman and Yli-Renko, 2010). Additionally, entrepreneurial environments might include other forms of unknowingness like complexity, ambiguity, and equivocality, which entrepreneurial activity aims to overcome (Townsend et al., 2018). The unknowable future complicates predictions of consequences and any kind of planning (Huang and Pearce, 2015). The uncertainty and unknowingness require distinguished forms of decision-making (Busenitz and Barney, 1997; Eisenhardt and Zbaracki, 1992; Schwenk, 1995; Wiltbank et al., 2006).

In uncertain environments, flexible and control-based decision-making appears advantageous (Alvarez, 2005; Mauer et al., 2018). Non-deliberative impulse-driven behavioural logics are more and more recognised as an appropriate perspective to account for uncertainty (Lerner et al., 2018; McVea, 2009). Moreover, in uncertain environments, outcomes result from shaping opportunities rather than from prediction (Wiltbank et al., 2006). For shaping opportunities in uncertain environment, effectuation appears more appropriate than causation (Laine and Galkina, 2017). In line with this notion, Wiltbank et al. (2009) empirically showed that high environmental uncertainty is related to effectuation, and Read et al. (2016) show the appropriateness of effectuation in unpredictable situations. Welter and Kim (2018) find that effectuation outperforms causation not only in uncertain but also in risky environments. They suggest effectuation as preferable decision-making logic whenever entrepreneurs cannot accurately enough predict the future. Frese et al. (2020) found uncertainty increases experimentation, as part of effectuation, and decreases causation. Thus, effectuation appears more appropriate than causation, in uncertain environments.

Second, the availability of resources might shape entrepreneurial decisions because the necessity of mobilising and transforming resources is key in any entrepreneurial setting (Clough et al., 2019). As effectuation uses means at hand and enables to mobilise resources, it appears particularly appropriate under resource constraints. While causation is preferred when a lot of resources are available, effectuation is preferred—particularly by novice entrepreneurs—when only few resources are available (Sarasvathy, 2008).

Third, entrepreneurial environments are mostly described as dynamic and competitive. Dynamism requires high pace of decision-making, and decision-making pace again is dependent on several factors including available resources and characteristics of the firm and industry (Wally and Baum, 1994; Edelman and Yli-Renko, 2010). Dynamic environments should pronounce the importance of attention allocation and recognising discontinuous change (Shepherd et al., 2007), favouring expedited exploitation (Bakker and Shepherd, 2017; Lerner et al., 2018). As continuous adaptation to change in a cyclic process better aligns with effectuation than causation, effectuation seems to be more appropriate than causation in dynamic environments. Supporting this notion, Wu et al. (2020) showed that effects of effectuation increase in situations of higher competitive intensity, due to the increased need of speedy adaptation. Similarly, Markowska et al. (2019) showed perceptions of dynamism decrease prediction orientation, which relates to decreased causation principles.

Finally, Sarasvathy (2008) and also Perry et al. (2012) explicitly suggest effectuation as a strategy that is appropriate for starting a new business, which also is the context in which the logic was identified (Sarasvathy, 2001). Supporting this idea, Villani et al. (2018) found effectuation to be less suitable for science-based than ‘traditional’ new venture creation.

All these perspectives suggest that, in entrepreneurial environments, effectuation appears more appropriate than causation (whether or not the decision-maker has entrepreneurial experience). Thus, we expect preferences for effectuation are higher in entrepreneurial environments (situations of starting a new business, having limited resources, facing high uncertainty) than in established environments (situations of being a manager of an established firm, having abundant resources, and being in a certain and stable situation). This leads to our second hypothesis:

*Hypothesis 2: Preference for effectuation over causation are higher in entrepreneurial environments than in established environments.*

### 3 Method

We test our hypotheses in an experimental vignette study. Vignette studies use realistic scenarios that are carefully constructed as short descriptions of a fictional situation (vignettes). Vignettes can include descriptions of a person, object, or situation, representing a systematic combination of characteristics (Atzmüller and Steiner, 2010; Aguinis and Bradley, 2014). The scenarios are presented to participants who then report their perceptions, judgements, and decisions in the respective situation. Vignette studies are common in several fields (such as HRM, marketing or innovation management) and have been recently used in entrepreneurship research more intensively (e.g., Burtch et al., 2015; Grégoire and Shepherd, 2012). Via a vignette study, we can investigate individuals’ decisions in a more effective and realistic way than by asking for their generally preferred

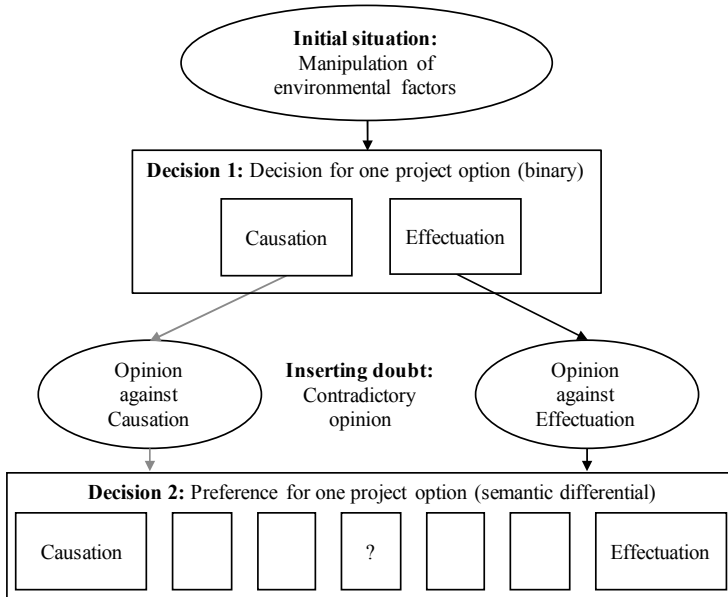
decision logic (Aguinis and Bradley, 2014), which was the focus of previous quantitative analyses of effectuation.

Systematically manipulating independent variables in a vignette allowed us to analyse causal relationships (Aguinis and Bradley, 2014; Stevenson et al., 2020). Participants reported their effectuation preferences in an entrepreneurial environment (being the founder of a new business, having only few resources, and the environment being uncertain) and in an established environment (being the manager of an established firm, having a lot of resources, and the environment being rather stable). The differences in the participants’ effectuation preferences in the entrepreneurial vs. the established environment can be directly linked to the effect of the environment because all other factors were held constant.

### 3.1 Study design

Figure 1 visualises the study design. We first present an initial situation that manipulates environmental factors. In one situation (established environment) participants imagine they are managers in established firms, have a lot of resources, and the environment is rather stable, whereas in the other situation (entrepreneurial environment) participants imagine they are founders of a new venture, have only few resources, and that the environment is uncertain and fast-growing. In the established environment, participants were managers of an established firm which operated in the data storage device industry. Participants are informed they should grow the business. In the entrepreneurial environment, participants were founders of a start-up in the computer chip industry, with few employees and limited financial resources. Participants are informed they should navigate their company in this fast-growing market.

**Figure 1** Experimental study design



Next, participants see two project options, one arguing with effectual, one with causal logics (see Table 1). The causation project is described by forecasts, there is a clear aim and an expected profit given, and decisions are proposed to be based on a competitive analysis. In contrast, the effectuation project plans research in many different directions, strengths are clearly outlined, cooperation is proposed to be enforced, and alternatives to be considered. Table 1 describes the manipulations of causation and effectuation in detail. The pre-study, as outlined in the next section, analysed whether the descriptions were perceived as intended.

**Table 1** Manipulations

<b>Construct</b>	<b>Manipulation</b>
<b>Entrepreneurial environment</b>	Manager in an established firm, a lot of resources, rather stable environment <i>vs.</i> founder, few resources, highly dynamic environment
<b>Causation</b>	<ul style="list-style-type: none"> <li>▪ Forecasts indicate that ...</li> <li>▪ The aim of this project is ...</li> <li>▪ A competitive analysis will be performed to prevail against competition ...</li> <li>▪ To accomplish ... a team has to be reinforced by additional employees with specialized know-how.</li> <li>▪ Technologies are patented so that no competitor can adopt</li> <li>▪ The expected profit is ...</li> </ul>
<b>Effectuation</b>	<ul style="list-style-type: none"> <li>▪ ...research in many different directions</li> <li>▪ The strength ... serves as starting point</li> <li>▪ Cooperation will be enforced</li> <li>▪ Create additional innovative product ideas</li> <li>▪ Project failure will not endanger the firm's survival</li> <li>▪ Dynamic changes are used to create alternative ... activities</li> </ul>

Participants see both project options (in randomised order) and make their first decision for one project, i.e., for effectuation or causation. After that, we insert doubt, by confronting them with a contradictory opinion of some fictional employees, to make them re-think their decision. This reconsideration stimulates a stronger cognitive involvement in the situation and allows for a more nuanced analysis of the participants' decisions. Then, they decide again and indicate on a sequential differential which project they prefer. Participants are then asked to explain their decision in an open text box. Finally, we ask for demographic information, including participants' experience with entrepreneurial activities. All participants go through both situations (entrepreneurial and established environment), in randomised order.

### 3.2 *Pre-study: developing the project descriptions contrasting causation and effectuation*

Since decision vignettes are a new approach to study effectual decision-making, we designed a pre-study to test and improve our project description vignettes that contrast causation and effectuation. For the design of the vignettes, we built on the conceptualisation and measurement of Brettel et al. (2012) because—in contrast to other measures (e.g., Chandler et al., 2011; Brettel et al., 2012) juxtapose causation and effectuation, which is necessary for our study design, in which participants should make a choice between the two project options.

To test our study design and the project description vignettes,<sup>1</sup> we conducted two subsequent online validation surveys and additionally had a discussion with test participants about their perceptions and thoughts that came to mind while conducting the study. To measure perceptions of the vignettes of participants in the pre-study ( $N = 50$ ), we adapted the scale by Brettel et al. (2012) which uses a semantic differential covering all 4 dimensions of effectuation vs. causation, using 4–7 items each. Each item consists of two contrasting statements, one matching the causation logic and the other matching the effectuation logic. We reformulated the original items such that they fit our project choice context. One sample item is: “The project is specified on the basis of given resources” vs. “The project is specified on the basis of given goals”. In the pre-study, we used all 23 items. We refined the project descriptions until the vignettes were distinct in each dimension. Table 1 shows the final vignettes (translated to English). Additionally, manipulation checks for the environment manipulation showed that participants perceived the situation descriptions significantly different regarding uncertainty, available resources, and for whether their firm is established or young.

### 3.3 Main study: studying effectuation preferences

*Sample.* All 100 main study participants ran through both manipulated situations (entrepreneurial vs established environment) in randomised order such that we can analyse responses in 200 decision situations. In the main study sample participants were 22% female, with an average age of  $M = 33.39$  and a range from 22 years up to 78 years ( $SD = 11.46$ ). 18% were students, 48% were currently employees, 30% currently self-employed, and 4% had other professions. 76% of the participants had a university degree, 9% a higher education entrance qualification (“Abitur”), 8% a PhD degree, 4% a secondary school certificate, and 3% held a master craftsmen certificate (“Meister”).

Our sample consisted of entrepreneurs (individuals who had founded a new business before) and non-entrepreneurs (employees). During our participant recruitment, we invited entrepreneurs and employees to make sure we have enough variance in entrepreneurial experience to be able to analyse its impact. In our final sample, 43 participants were entrepreneurs, 57 did not have entrepreneurial experience.

*Measurements.* In order to measure entrepreneurial experience, we asked participants whether they have founded a venture before (Farmer et al., 2011). We used this dummy variable for our final analysis. Following the approach of Davidsson and Honig (2003), we did additional robustness checks, for which we had also asked participants whether they have engaged in any entrepreneurial activities including business planning seminars, assembling a team to discuss business ideas, etc. Calculations with combinations of these other indicators of entrepreneurial experience showed the same results as the ones presented in the next section. Entrepreneurial environment was not measured but manipulated in the vignettes. Due to the influence of gender, age, and education on entrepreneurial activity (Bosma et al., 2020), we controlled for their influences.

*Manipulation checks.* In the main study, we used one item per dimension of the adapted Brettel et al. (2012) scale (adaptation see pre-study) as a manipulation check. T-test

analyses showed that the manipulation was successful as the effectuation project was rated significantly different from the causation project in each dimension: Means vs. goals ( $T = 22.803$ ;  $p = 0.000$ ), affordable loss vs. expected return ( $T = 13.241$ ;  $p = 0.000$ ), partnerships vs. competitive analysis ( $T = 25.756$ ;  $p = 0.000$ ), leverage contingencies vs. avoid contingencies ( $T = 23.285$ ;  $p = 0.000$ ).

## 4 Results

Table 2 presents correlations and descriptive statistics. Age correlates with entrepreneurial experience ( $r = 0.229$ ;  $p = 0.001$ ), which fits expectations as individuals are more likely to have entrepreneurial experience when they are older. Being female correlates with a decision for effectuation:  $r$  (decision 1) = 0.182;  $p = 0.010$ ;  $r$  (decision 2) = 0.155;  $p = 0.028$ . Decision 1 and 2 correlate with each other ( $r = 0.710$ ;  $p = 0.000$ ). Please see the exploratory analyses for a more detailed analysis and discussion of the stability of the decisions and the gender effects.

Since all 100 participants ran through both situations, we could analyse 200 times decision 1, and 200 times decision 2. Because of the multi-level structure of the data, we used a generalised estimating equation (GEE). For the analysis of predictors of decision 1, we used a logistic regression because decision 1 is a binary measure. For the analysis of predictors of decision 2, we used a linear regression model assuming normal distribution because participants could indicate which project they prefer on a semantic differential (1–7). Table 3 presents the results of three regression models: An analysis of predictors of decision 1, decision 2, and the change from decision 1 to decision 2.

### 4.1 Hypotheses tests

In our data, the manipulation of environmental factors predicts whether participants choose a project that uses effectual or a project that uses causal logics. In the entrepreneurial environment, participants chose significantly more often the effectuation project in their initial decision ( $b = 1.16$ ;  $p = 0.00$ ) as well as after being confronted with a contradictory opinion ( $b = 0.62$ ;  $p = 0.02$ ). These findings suggest that effectuation appears more appropriate in an entrepreneurial environment, lending support for hypothesis 2. However, whether decision-makers had entrepreneurial experience did not predict their decision, neither in the first ( $b = -0.27$ ;  $p = 0.42$ ) nor in the second ( $b = 0.13$ ;  $p = 0.71$ ) decision. Thus, hypothesis 1 is not supported. As several researchers have also argued for interrelationships among environmental characteristics, individual perceptions, and entrepreneurial efforts (Sarasvathy, 2008; Edelman and Yli-Renko, 2010; Hmieleski et al., 2013; Mole and Mole, 2010), we also calculated an interaction between entrepreneurial environment and entrepreneurial experience; but the interaction effect was not significant. Summing up, we can conclude that, among our participants, environmental factors, i.e., being in an entrepreneurial vs. established environment, predicted a preference for effectuation over causation but whether decision-makers had entrepreneurial experience did not change their decisions.

**Table 2** Inter-correlations

Variable	Mean	S.D.	1		2		3		4		5		6		7	
			r	sig	r	sig	r	sig	r	sig	r	sig	r	sig	r	sig
1 Age	33.39	11.43	1													
2 Gender	1.22	.42	-.005	.939												
3 Decision 1: Effectuation (0/1)	.46	.50	-.019	.788	.182**	.010										
4 Decision 2: Effectuation (1-7)	3.93	2.18	-.052	.467	.155*	.028	.710**	.000	1							
5 Change from one logic to the other (1-7)	2.45	1.54	-.113	.111	.009	.895	-.025	0.724	-.029	.68	1					
6 Entrepreneurial Environment (0/1)	.50	.50	.000	1.000	-.000	1.000	.271**	.000	.142*	.045	-.11	.119	1			
7 Entrepreneurial Experience (0/1)	.43	.50	.229**	.001	.026	.711	-.040	.571	.014	.844	-.064	-.370	.000	1.000	1	
8 Higher Education (0/1)	.86	.35	.102	.150	-.134	.059	-.057	.421	.020	.778	-.135	.057	.000	1.000	-.115	.104

Note: \*\* Correlation is significant at the 0.01 level (2-tailed). \* Correlation is significant at the 0.05 level (2-tailed).

**Table 3** GEE regression analyses

	DV: Decision 1 (binary, effectuation = 1)			DV: Decision 2 (semantic differential, effectuation = 7)			DV: Change from one logic to the other logic		
	b	Wald $\chi^2$	p	b	Wald $\chi^2$	p	b	Wald $\chi^2$	p
Controls									
Age	.007	.258	.612	-.012	.473	.491	-.011	1.343	.246
Gender*	.954	6.132	.013	.848	4.622	.032	-.026	.008	.929
Higher Education	-.283	.348	.555	.324	.429	.512	-.594	2.003	.157
Independent Variables									
Entrepreneurial Environment	1.164	15.688	.000	.620	5.810	.016	-.338	.001	.084
Entrepreneurship Experience	-.266	.657	.418	.133	.137	.711	-.185	.689	.406
Decision 1: Effectuation							-.006	2.991	.981

Note: \*1 for male, 2 for female



#### *4.2 Exploratory Analysis 1: Stability of the decision*

The contradictory opinion, which we implemented between the two decisions that are made in each decision situation, intended to stimulate cognitive processes and participants' involvement, and thus might have influenced the decision process. Thus, we additionally analysed whether or not individuals change their decision after being confronted with this contradictory opinion of their employees. Building on the reasoning of Appelhoff et al. (2016), we expected that a statement based on causal logics might be more convincing such that the probability to change the decision is higher when a participant first chose the effectuation project. We assumed a justification of effectuation appears more difficult for the participants than arguing with causal logics. Accordingly, we expected participants would be more likely to change a decision in case they had chosen effectuation than when they had chosen causation.

To explore this assumption, we investigated in participants' second decision whether they remained with their tendency towards effectuation or causation, compared to the first decision, or whether they tended to change their decision. To create the change variable, we used the semantic differential of the second decision, recoded in accordance to the first decision, such that (in case the first decision was e.g., for effectuation) a 7 (e.g., for causation) indicated a strong decision, while a 1 (e.g., again for effectuation) indicated no change. However, we did not find an effect of the factor indicating whether participants' first decision was causation or effectuation on the change (see Table 3). As the stability of one's opinion has been shown to be dependent on the kind and the strength of dissent and on situational circumstances including team cohesion (Dooley and Fryxell, 1999; Nemeth et al., 2001), a contradictory opinion of external stakeholders, instead of employees, might make the difference we had assumed.

#### *4.3 Exploratory Analysis 2: Gender effects*

In our data (see Table 3) gender predicted a decision for effectuation such that women were more likely than men to choose effectuation in their first decision ( $b = -0.95$ ;  $p = 0.01$ ) as well as after being confronted with a contradictory opinion ( $b = -0.85$ ;  $p = 0.03$ ). While more and more women start new ventures, still significantly more men than women act as entrepreneurs (see the Global Entrepreneurship Monitor). Women seem to perceive themselves and the entrepreneurial environment in a less favourable light (Frigotto and Valle, 2018; Langowitz and Minniti, 2007). Entrepreneurial activity differs across genders for many different reasons (Byrne and Worthy, 2015; Byrnes et al., 1999; Dawson and Henley, 2015).

Research on gender stereotypes provides some potential explanations why women may prefer effectuation more than men. Due to stereotypes, women are expected to be more communal than men meaning that women are expected to be supportive and show cooperative behaviour (Feingold, 1994; Eagly and Mladinic, 1994; Heilman and Eagly, 2008). This kind of behaviour better fits the 'thinking in partnerships' principle of effectuation than the 'competitive analysis' principle of causation (Oostenbrink et al., 2012). Therefore, when women feel a pressure to fit the female stereotype, effectuation might be more likely to appear appropriate to them.

Additionally, (whether nurture or nature) men have been found to be more prone to risk taking than women (e.g., Byrnes et al., 1999). The affordable loss principle of effectuation seems to decrease the perception that survival is at risk such that the causation project is perceived riskier than the effectuation project (see also the findings of the qualitative validation study). Women's tendency towards risk aversion, or their feeling of being expected to behave risk averse, might therefore make them choose the effectuation project. This is in line with Frigotto and Valle (2018) who found that women refer to the affordable loss principle more often than men. However, they also found that men are more confident in exploiting resources, which increases men's tendency towards effectuation more than women's. Thus, the relationship between gender and effectuation might be more complex and needs further investigation.

#### *4.4 Qualitative validation: thinking aloud protocols and qualitative analysis of participants' reasoning for their decision-making*

To provide an even better understanding of the decision-making processes, we additionally analysed two sources of qualitative data:

- 1 Participants' explanations of their decisions. In the main-study experiment, participants were asked to explain their decision in six to thirty words in an open text box.
- 2 Thinking aloud protocols of the decision process.

We conducted thinking aloud interviews with 18 additional participants analysing their decision process during the experiment procedure. Thinking aloud requires participants to verbalise their decision-making while attending to information, making it appropriate for our aim to discover the cognitive processes and strategies underlying participants' decisions (Ericsson and Simon, 1980). In thinking aloud studies, participants explain in the decision-making experiment continuously how they make decisions. The protocols were recorded and transcribed. The participants were encouraged to specifically state all their motives leading to their decision. If only a very short and imprecise explanation was offered, the person was asked to elaborate on the decision criteria. The sample for the thinking aloud experiment consisted of nine entrepreneurs (five men and four women in an age range from 25 to 56 years), and nine non-entrepreneurs who were working as employees (five men and four women in an age range from 24 to 28 years).

Based on coding of participants' statements, a coding scheme was developed which included theoretically driven dimensions, particularly built on the concepts of effectuation and causation, but we did not limit our analysis to these concepts. For the analysis, participants' statements were broken down into segments that could be allocated to one fitting dimension. Whenever a statement included more than one manifestation, it was divided into pieces and allocated accordingly. When segments seemed to fit more than one dimension, dimensions were changed to ensure distinctiveness. After creating a list of specific categories from theory, categories were expanded by iteratively adding and regrouping participants' statements.

**Table 4** Decision criteria analysis

**Participants explain their decision referring to....**

...when they chose	Effectuation	vs.	Causation
...in a	Entrepreneurial environment	Market situation	Established environment
High competition Market yields a lot Environment/competition	Less inscure Lower financial risk Lower loss in case of failure More safety Failure can be absorbed	Entrepreneurial environment Stand out from competitors Establish oneself Own technology against competitors Suppress competitors	Established environment Entice the best employees Stand out from competitors Establish oneself Own technology against competitors Suppress competitors
Low risk/ sustainable development Low risk/ low capital investment Low risk/ mistakes affordable Survival not at risk	Lower financial risk Lower loss in case of failure More safety Failure can be absorbed	<b>Risk/ Profit</b> Low risk Financial capital provides security	<b>Risk/ Profit</b> Low risk Financial capital provides security
Risk of other project too high for a start-up Not enough know how for the other project Employees not yet recruited As much information as possible	Know-how of other companies Enough know-how	Employees' know-how / patent development Know-How Patent	<b>Know-How (Means)</b> Means at hand Patent Knowledge advantage/ having an invention Research team is with me
Experienced team Small Team Team already selected	Recruiting inscure Employees not yet recruited Competent employees Speculations on recruitment in other project	New employees with know-how New employees	<b>Employees (Means)</b> Promising work has been done
Cooperation for security Project should better be operated together Partner organisations' strong partners No cooperation is risky Idea exchange Confidentiality not good	Partnerships strengthen companies Cooperation produces new and more ideas Partner's know-how Partnerships Networking/ cooperation Synergies	Keep ideas for yourself Confidentiality No autonomy/ cooperation hinders progress Add additional companies is difficult Partnerships with established firms are difficult Don't share revenue Success chances More profit possible	<b>No Partnerships</b> Own decisions, no compromise No cooperation Too much insights into the firm Do it by myself
New products More opportunities Other project opportunities unclear Niche	Win in the long run More opportunities More opportunities for ideas and employment Gains for research	More profit possible	<b>Opportunities</b> Increase revenue More profit expected More potential than risk Good chances Profitable
Other project is too specialised We will find something Opportunities to develop Different directions Diversity for different ideas Don't commit More open React to the unexpected	Unforeseen ideas We can see later on	Financial capital is missing (in other project) Fix plan (no plan in other project) Other project will get bogged down No use and no goal in other project Next step is only implementing A start-up should not research in the wild Other project not enough focus	<b>Goals/ Planning</b> Preceding planning Goal oriented Described path Other project no use Very good predictions Clear direction Concrete profit estimate
Analysis is just an assumption No reliance on predictions	No analysis/ prediction	Existential threat unlikely Project does not necessarily risk survival Losses can be absorbed by ongoing business Market position justifies risk	<b>Affordable loss irrelevant</b> Existential threat unlikely Project does not necessarily risk survival Losses can be absorbed by ongoing business Market position justifies risk

This analysis indicated that participants often referred to aspects that could be linked to the concepts of effectuation and causation (see Table 4). Several statements indicate their decisions for causation or effectuation were independent of the situation (entrepreneurial vs. established environment): When participants prefer effectuation, they for example perceive lower risk or less costs (affordable loss) or refer to the know-how or employees which are at hand (means orientation). When participants prefer causation, they for example think the casual approach is more promising (expected return) or refer to the analysed competitive advantage. Interestingly, partnerships are by some participants interpreted positively (cooperation) by others negatively (lost independence), and both interpretations occurred in both situations (entrepreneurial vs. established). We also found statements for all our categories by entrepreneurs as well as non-entrepreneurs.

Other statements provide explanations in what way the environment matters: In the established environment, several participants who chose the causation project argued that the existence is not in danger (affordable loss principle irrelevant). Accordingly, making sure investments are restricted to an affordable amount is seen inappropriate in established environments such that the affordable loss argument works for effectuation in the entrepreneurial but does not make sense in the established environment. Interestingly, participants who chose effectuation often referred to the market situation as decision criteria when they were in the entrepreneurial environment, but no participant did so in the established environment. The flexibility and openness provided by the effectuation project was also way more often referred to in the entrepreneurial environment than in the established environment. Additionally, in the entrepreneurial environment, the causal predictions were considered uncertain and unreliable. These findings indicate that particularly the effectual affordable loss principle, flexibility, and openness, which are not relevant in the established environment, and the causal predictions, which are considered unreliable in entrepreneurial environments, might drive the differences in participants' decisions.

## **5 Discussion**

This paper intended to provide a better understanding of why entrepreneurs apply effectual logics. More specifically, we investigated whether environmental factors determine preferences for effectuation vs. causation, and whether preferences differ for individuals with or without entrepreneurial experience. Additionally, we analysed the decision criteria and decision process in effectuation vs. causation decisions. Moreover, our exploratory analyses showed gender differences in effectuation preferences. In the following, we discuss our findings and implications for future research.

### *5.1 Individual vs. environmental factors as predictors of effectuation preferences*

Previous research suggested individual as well as environmental factors as predictors of effectuation preferences (Saravathy, 2008). Most previous studies did not disentangle whether it is entrepreneurs who have a particular ability to think entrepreneurially, making them apply effectuation, or whether anybody would in an entrepreneurial environment decide the same way. Among the participants in our study, environmental

factors predicted a decision for effectuation – for both entrepreneurs and non-entrepreneurs. However, whether decision-makers had entrepreneurial experience did not predict their preferences. These findings address a recent call which claims that effectuation research needs to spell out the conditions of alternate approaches in more detail (Read et al., 2016). We show environmental factors influence preferences for causation vs. effectuation, while individual experience did not have an effect, at least in our sample. Future research should therefore consider that the nature of the decision situation might account for entrepreneurs' effectuation preferences, more than previous individual experiences.

### *5.2 The reasoning underlying entrepreneurial decision-making*

We not only analysed predictors of effectuation vs. causation decisions but also decision criteria and processes. We found effectuation was chosen because it was perceived as lower risk or less cost intensive than causation, and because using the know-how or employees at hand was perceived to be beneficial. Causation was chosen because it was perceived more promising than effectuation and because developing a competitive advantage was seen important. Building partnerships, which was part of the effectuation choice, was either interpreted positively (cooperation) or negatively (lost independence). Thus, our findings suggest each effectuation dimension evokes distinct interpretations. Therefore, we advocate effectuation dimensions build a formative construct and need to be manipulated and analysed separately, as also suggested by Appelhoff et al. (2016), Palmié et al. (2019) or Frese et al. (2020).

Additionally, our findings show why the environment matters for a decision for or against effectuation. As the firm's existence is, in an established environment, not perceived in danger, restricting investments to an affordable amount (affordable loss) is seen irrelevant. Moreover, establishing flexibility and openness, and constantly accounting for the market situation, appear to be criteria to choose effectuation, but only in the entrepreneurial environment. The causal predictions seem, in the entrepreneurial environment, too uncertain. Accordingly, several effectuation dimensions are not considered appropriate in an established environment. This is in line with previous research which suggests that particular perceptions of the environment influence preferences for effectuation and abilities to apply effectuation (Frese et al., 2020; Markowska et al., 2019; Parida et al., 2016). Our study advances those previous ideas by showing that effectuation preferences can be stimulated by exogenous (manipulated) environmental differences, which then stimulate particular effectuation-related perceptions. Our data suggests effectuation is perceived inherently connected to the entrepreneurial environment and this connection drives decisions for effectuation.

### *5.3 Gender differences in entrepreneurial decision-making*

Our exploratory data analyses investigated gender differences in effectuation preferences. In our data, gender predicted a decision for effectuation, such that women were more likely to choose effectuation. This finding was surprising and interesting, as it is congruent with research on female stereotypes and role congruity theory (Feingold, 1994; Eagly and Karau, 2002; Eagly and Mladinic, 1994; Heilman and Eagly, 2008). Drawing on role congruity theory, and more specifically research on gender stereotypes, we argue that women's decisions could be influenced by the perceived pressure to fit the female

stereotype, which is related to risk aversion and caring behaviours. Women might feel that the logics of effectuation, which do not put the venture's survival at risk, and emphasise thinking in partnerships, better fit what is expected from them. Their perceptions that effectuation better fits with what is expected from them might be one reason why women are more likely to choose effectuation than men. Since effectuation seems appropriate in entrepreneurial environments, and better fits the female stereotype than causation, effectuation could—for women in particular—be a suitable way to achieve entrepreneurial success. However, as this was an explorative finding in our study, more research is needed to replicate the finding and investigate the mechanism in more detail.

#### *5.4 The value of vignette-studies in effectuation research*

Our vignette study disentangles predictors of decisions for effectuation, which were intertwined in most previous studies. Presenting a vignette-study, which manipulates environmental differences, offers a new approach for studying effectual decision-making and provides a possibility to account for endogeneity (Anderson et al., 2022), a problem in many previous studies (Perry et al., 2012). Such an experimental approach advances previous knowledge because it does not rely on measuring perceptions of environmental factors. Manipulating the environment instead of measuring perceptions provides interesting new insights because perceptions of the environment (e.g., its controllability) also differ across individuals and influence their ability to apply effectuation (Parida et al., 2016). To reach a comprehensive picture, which allows causal conclusions, we encourage future effectuation research to enrich the often applied qualitative and theoretical approaches not only with investigations of secondary data and quantitative surveys, but also with experimental approaches such as vignette studies.

#### *5.5 Limitations, avenues for future research, and implications for practitioners*

Haynie et al. (2010) propose it is impossible to separate the actor from the context. Following Shepherd et al. (2007), they argue certain motivational states activate specific cognitive interpretations, which influence whether or not a change is perceived as opportunity worth acting upon. Such interpretations depend on how entrepreneurs understand and interact with the environment (Upson et al., 2017). The environment can influence cognitive schemas which in turn influence decision-making (Fernández-Pérez et al., 2016). Thus, entrepreneurs' cognitive interpretations, heuristics and motivations, and their interaction with the environment, are worth analysing in more detail. While our data does not show any interaction between the manipulated entrepreneurial differences and decision-makers' entrepreneurial experience, perceptions of the environment might still differ for different individuals. Therefore, we suggest to further explore the interaction effects of the environment, individual differences in pre-dispositions, and individual differences in perceptions on effectuation in future studies. Future analyses could, for example, combine our findings with the results of Hmieleski et al. (2013), who found interactions of individual optimism and environmental dynamism, or of Stroe et al. (2018), who showed configurations of individual perceptions and pre-dispositions that allow for effective effectuation usage. We suggest future research should dive deeper into the interplay of environmental factors with individual perceptions, experiences, and pre-dispositions.

Our methodological approach also has limitations. Our participants were reporting their preferences in a scenario with a hypothetical situation. Although we thoroughly constructed the scenarios and did a pre-test to ensure they are perceived realistic, we would encourage future research to validate our findings with field data in order to test the finding's external validity. Future research may use our study as a starting point to delve more deeply into specifics of the entrepreneurial environment and effectuation. While we used a generalist approach towards the two dimensions, it is possible that different dimensions of effectuation (e.g., experimentation) and the environment (e.g., resource limitations or uncertainty) have specific and distinct effects. Future research may further uncover these dimensions and their respective effect in more detail. Moreover, our measurement of entrepreneurial experiences asking whether participants had previously founded a business or not (and the measurement for the robustness checks asking whether they had engaged in entrepreneurship related training or activities) might not have captured all facets of entrepreneurial experience. Additional investigations with more detailed measurements of entrepreneurial experiences, e.g., capturing what kind of businesses the entrepreneurs founded or whether employees were engaged in innovation projects, could provide additional insights.

As effectuation seems to be connected to the entrepreneurial environment, entrepreneurs should be cautious with effectuation suggestions. They need to interpret their specific decision context and derive from environmental characteristics which effectuation principle does or does not fit their decision situation. As effectuation seems to fit the female stereotype better than causation, effectuation might, in case it fits the situation, be a particularly fruitful strategy for women who have to balance expectations connected to the female stereotype and entrepreneurial stereotypes.

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## Note

<sup>1</sup>As we conducted the study in Germany, we created vignettes in German.