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# Measuring entrepreneurs' use of effectuation as heuristics: Development and validation of a situational judgment test (SJT) for effectuation

Sonia Koller [a,*], Gorkan Ahmetoglu [b], Ute Stephan [a]

[a] King's College London, King's Business School, 30 Aldwych, London WC2B 4BG, United Kingdom
[b] Division of Psychology and Language Sciences, University College London, 26 Bedford Way, London WC1H 0AP, United Kingdom

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ABSTRACT

Effectuation is a key theory of entrepreneurial decision-making. However, measuring effectuation remains challenging. Existing measures use self-report scales that rely on recall and aggregate across diverse past situations. Such measures cannot capture effectuation as a decision-making logic based on heuristics. Leveraging insights from extant work on situational judgment tests (SJT) in applied psychology, we develop and validate an effectuation SJT that captures the implicit nature of entrepreneurs' use of effectuation in specific situations. Across seven studies including a 14-month prospective panel study, we establish the construct, predictive and incremental validity of the new SJT for venture outcomes. Methodologically, this novel SJT of effectuation facilitates new types of research, such as unpacking the cognitive underpinnings of effectuation. Theoretically, our study offers new conceptual clarity about effectual principles and their impacts on venture outcomes by leveraging extant work on heuristics in the cognitive sciences. We also introduce SJTs as a new method of value to specific streams of entrepreneurship research.

## Executive summary

Effectuation, a decision-making logic emphasizing control over prediction, is a prominent framework for understanding entrepreneurial decision-making. Recent research has shown that effectual principles cognitively function as heuristics in entrepreneurs' decision-making – broadly cognitive strategies that ignore part of the information available in order to make fast and frugal decisions. This theoretical stance of 'effectuation as heuristics' highlights that entrepreneurs use effectuation in an implicit, situation-specific manner. Nevertheless, these theoretical and empirical developments on the construct of effectuation as heuristics have not yet been integrated into its measurement. Current self-report measures ask entrepreneurs to aggregate recollections across diverse situations (from mobilizing resources, attracting employees, to developing product prototypes), and thus cannot capture how entrepreneurs switch and adapt their use of effectuation to make decisions in specific situations. Furthermore, due to their retrospective nature, self-reports can lead to rationalization: thus overreporting causation, and underreporting effectuation—which is driven by implicit cognitive processes.

We propose that a more appropriate method for capturing effectuation as heuristics is the situational judgment test (SJT). The SJT

* Corresponding author at: King's Business School, King's College London, 30 Aldwych, London WC2B 4BG, United Kingdom.
*E-mail addresses:* sonia-cristina.codreanu@kcl.ac.uk (S. Koller), g.ahmetoglu@ucl.ac.uk (G. Ahmetoglu), ute.stephan@kcl.ac.uk (U. Stephan).

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is an assessment method that was developed to capture judgment and decision-making in specific situations. SJTs are a simulation method that focuses on assessing real-time, implicit cognitive processes that decision-makers may otherwise be unaware of. SJTs have been widely used and researched in the industrial-organizational (I/O)/ applied psychology literature and show strong evidence of construct and criterion-related, incremental validity for job performance over self-report predictors.

Over three pilot and four main studies, we develop and validate a new SJT of effectuation. We explore and confirm its factor structure, we examine its construct, as well as its predictive, criterion-related and incremental validity for venture outcomes.

With this work, we make three key contributions to the entrepreneurship literature: (1) we make a methodological contribution to effectuation research by introducing a novel, validated SJT measure of effectuation that has significant strengths and complements existing, self-report measures of effectuation; (2) we make a theoretical contribution by enhancing and refining the theoretical understanding of effectual principles, as well as their impacts on venture performance; and (3) we introduce SJTs to entrepreneurship research and identify streams of research which could benefit from their adoption.

## 1. Introduction

Effectuation, a decision-making logic emphasizing control over prediction, is a prominent theory for understanding entrepreneurial decision-making (Grégoire and Cherchem, 2020). It elucidates how entrepreneurs make decisions under uncertainty in the process of new venture creation (Dew et al., 2009a; Sarasvathy, 2001a). The theory specifies four principles that underpin effectual logics, namely entrepreneurs' focus on means, affordable loss, leverage contingencies, and co-creation, and contrasts these with causal logics, namely prediction, maximize returns, avoid contingencies, and competitiveness (Sarasvathy, 2008; Sarasvathy, 2001a; Wiltbank et al., 2006). Recent research (Koller et al., 2022) has shown that effectual principles cognitively function as *heuristics* in entrepreneurs' decision-making – that is, as cognitive strategies that ignore part of the information available in order to make fast and frugal decisions (Gigerenzer and Gaissmaier, 2011; Zhang et al., 2021; Zhang and Cueto, 2017).

This heuristics perspective emphasizes that effectual principles help entrepreneurs achieve *decision-fit* in specific situations, i.e. perceived fit between the decision logic and the situation (Gigerenzer and Gaissmaier, 2011). For instance, affordable loss helps entrepreneurs make resource allocation decisions, whereas co-creation helps entrepreneurs make decisions involving stakeholder relationships (Koller et al., 2022). Similarly, process studies suggest that situations high in uncertainty and resource scarcity lead entrepreneurs to use effectuation (Jiang and Tornikoski, 2019; Reymen et al., 2015), whereas situations that are less complex and where decision consequences are more costly drive entrepreneurs to use causation (Koller et al., 2022). These results are congruent with a large body of research on heuristics, outside of entrepreneurship, which shows that heuristics can be conceptualized as cognitive tools that people use to deal with complex decisions in *specific* situations (Gigerenzer et al., 1999; Gigerenzer and Gaissmaier, 2011; Todd et al., 2012). Therefore, this perspective helps to overcome uncertainty in past research about why and when effectuation and its principles, are deployed, and why and when it is combined with causation (Grégoire and Cherchem, 2020). However, we currently lack a way to measure effectuation in line with these recent advances to capture effectuation as heuristics used in specific situations.

Valid and reliable measurement is a critical foundation for any research area. Yet despite the rapidly expanding research on effectuation, its measurement in quantitative research remains challenging and controversial (Arend et al., 2015; Grégoire and Cherchem, 2020; Perry et al., 2012). A recent review concluded that existing effectuation measures do not consistently capture entrepreneurs' use of effectuation across distinct decisions and situations (McKelvie et al., 2020). We argue that this is because existing measures of effectuation do not capture the situation-specific, implicit nature of effectuation as heuristics. Firstly, existing self-report measures of effectuation use generalized behavioral statements and Likert-scales (Brettel et al., 2012; Chandler et al., 2011). These require entrepreneurs to recall and mentally aggregate their behavior and decision-making across diverse situations ranging from mobilizing resources, attracting employees, to developing product prototypes.[1] That is, current effectuation measures, by design, assess entrepreneurs' recollections of their *typical* behaviors (or decision-making approach) *across* situations, rather than their situation-specific use of effectuation as heuristics. Thus, current self-report measures cannot capture how entrepreneurs switch and adapt their use of effectuation to make decisions in specific situations (Jiang and Tornikoski, 2019; Koller et al., 2022; Reymen et al., 2015).

Secondly, by asking entrepreneurs to retrospectively recall how they have behaved or made decisions over a time period (sometimes two or three years in the past) (Chandler et al., 2011; Werhahn et al., 2015), these self-reports may result in 'rationalized' recollections[2] (Podsakoff et al., 2003; Schwenk, 1985), which have been associated with causation (Reymen et al., 2015). Thus, research carried out using existing self-report measures is likely to *underreport* entrepreneurs' use of effectuation. Critically, effectuation as a form of heuristic decision-making developed through experience and expertise, is used implicitly and intuitively by entrepreneurs (Read and Sarasvathy, 2005; Sarasvathy, 2008; Wiltbank et al., 2009). This makes it difficult to consciously access and report upon, because decision-makers are mostly unaware of using heuristics (Gigerenzer, 2007; Gigerenzer and Gaissmaier, 2011). This is why in the cognitive sciences and psychology literature, individuals' use of heuristics is invariably assessed as part of simulated or real decision-making tasks, i.e. in *specific* and concurrent situations (Todd et al., 2012). Indeed, early studies on entrepreneurs' effectuation also employed real-time, simulated decision-making tasks using think-aloud protocols (Sarasvathy, 2001b; Sarasvathy,

[1] An example item is: [During the venture creation process] "We adapted what we were doing to the resources we had" (Chandler et al., 2011).

[2] Research assessing decision-making processes using retrospective recall shows that individuals recall their decision-making following a rational, goal-directed process; whereas research assessing decision-making processes using more concurrent methods shows that decision-makers follow non-linear, intuitive reasoning (Schwenk, 1985).

2008). In sum, to capture effectuation as heuristics we need to measure entrepreneurs' situation-specific, implicit use of effectuation (Koller et al., 2022; Zhang and Cueto, 2017).

We propose that a particularly appropriate method for capturing effectuation as heuristics is the situational judgment test (SJT). The SJT is an assessment method that was developed to capture judgment and decision-making in specific situations (Bledow and Frese, 2009; Christian et al., 2010). SJTs consist of scenarios that describe one situation in detail and provide a series of response options, capturing the decision-making logic the entrepreneur uses in that specific situation. Thus, SJTs are a simulation method (Motowidlo et al., 1990; Weekley et al., 2015) that focuses on assessing real-time, implicit cognitive processes that decision-makers may otherwise be unaware of (Motowidlo et al., 2006). It does so by focusing on specific situations and decisions (Bledow and Frese, 2009; Suchman, 1987). Thus, SJTs can help better capture both the implicit cognitive processes underpinning effectuation and its situation-specific use (Koller et al., 2022; Reymen et al., 2015). SJTs can assess both rational (i.e. causation) and heuristic decision-making (i.e., effectuation) (Brooks and Highhouse, 2005).

SJTs have been widely used in different literatures (Kepes et al., 2024; Weekley et al., 2015). For instance, as measures of implicit processes underpinning unethical decision-making (Kligyte et al., 2013; Mumford et al., 2006), to assess personal initiative (Bledow and Frese, 2009), emotion regulation (Koschmieder and Neubauer, 2021), cultural orientations (König et al., 2010; König et al., 2007), and personality (Motowidlo et al., 2006; Oostrom et al., 2019). Importantly, research in the industrial-organizational (I/O), applied psychology literature shows high criterion-related validity of SJTs for predicting job performance, as well as demonstrates that SJTs have incremental validity over well-established self-report predictors of job performance (Chan and Schmitt, 2002; Christian et al., 2010; Clevenger et al., 2001; Weekley et al., 2015).

In this paper, we develop and validate a new SJT to assess effectuation as heuristics. We conduct, first, three pilot studies to generate decision scenarios and response options, and second, four main studies. In main Study 1, we develop the measure and explore its factor structure. In Study 2, we refine the measure. In Study 3, we test our SJT using alternative referents comparing scenarios written in a 1st and 3rd person referent. In Study 4, we confirm the factor structure of the SJT, examine its convergent and discriminant validity with a widely used self-report measure of effectuation (Chandler et al., 2011), as well as offer evidence for the predictive and incremental, criterion-related validity of the SJT for venture outcomes.

We make three key contributions. Firstly, we make a methodological contribution to effectuation research by introducing a novel, validated SJT measure of effectuation that has significant strengths and complements existing, self-report measures of effectuation. We achieve this by building on recent research on effectuation as heuristics (Koller et al., 2022; Zhang and Cueto, 2017). The SJT enables a valid and accurate assessment of entrepreneurs' use of effectuation by capturing implicit cognitive processes using simulated, specific decisions. The SJT can facilitate new research such as research clarifying the micro-foundations of effectuation and its principles as heuristic decision-making through a cognitive science lens (Koller et al., 2022; Shepherd et al., 2015; Zhang and Cueto, 2017), as well as experimental research (Grégoire et al., 2019) to test causal claims about the antecedents driving effectuation, and research to understand whether effectuation can be taught.

Secondly, we make a theoretical contribution by enhancing and refining the theoretical understanding of effectuation and its principles (MacKenzie et al., 2011; Podsakoff et al., 2016), as well as their impacts on venture performance (Arend et al., 2015; Read et al., 2009). We conceptualize effectual principles as entrepreneurial heuristics used for specific situations and types of decisions (e.g., resource mobilization, resource use), and conceptually link them to specific venture outcomes using our new measure. Viewing effectual principles as heuristics enables us to better understand when (i.e. in which *specific situations*) effectual principles predict higher venture performance (Gigerenzer and Gaissmaier, 2011; Mousavi and Gigerenzer, 2017; Todd et al., 2012). It also helps us understand *why* effectual principles may relate to some venture outcomes, but not others – because effectual principles align with and support achieving certain outcomes in specific situations (Koller et al., 2022).

Thirdly, we introduce SJTs to entrepreneurship research and identify streams of entrepreneurship research which could benefit from the adoption of the SJT methodology. Specifically, these are research areas that would benefit from the concurrent, simulation-based assessment approach of SJTs that allows to capture implicit processes and situational dynamics. In particular, SJTs can enable future research to (1) directly assess non-rational and intuitive cognitive and action logics (Lerner et al., 2018; Pollack et al., 2023; van Lent et al., 2024), (2) document implicit cognitive processes, as well as processes affected by social desirability, related to the destructive side of entrepreneurship, such as unethical decision-making (Shepherd, 2019), and they can (3) further our understanding of situated cognition (Mitchell et al., 2021; Mitchell et al., 2011).

## 2. Theoretical background

### 2.1. Effectuation as heuristics

Effectuation theory describes the decision-making logics entrepreneurs use to navigate uncertainty (Sarasvathy, 2008; Sarasvathy, 2001a). Effectuation is one of the most researched constructs in the entrepreneurship literature (Fisher, 2012; Grégoire and Cherchem, 2020; McKelvie et al., 2020). According to Sarasvathy (2001a), effectual and contrasting causal logics consist of four principles: *focus on means* vs. *prediction, affordable loss* vs. *maximize returns, leverage contingencies* vs. *avoid contingencies,* and *co-creation* vs. *competitiveness* (Brettel et al., 2012; Fisher, 2012). Accumulating empirical evidence now demonstrates that effectuation and causation can be combined (Koller et al., 2022; Smolka et al., 2018). It highlights the advantages of such a hybrid approach, where entrepreneurs shift between effectuation and causation at different stages of venture development and for specific situations (Jiang and Tornikoski, 2019; Reymen et al., 2015).

Recently, effectuation research has turned to exploring the cognitive underpinnings of effectuation and has sought to integrate

effectuation with the broader field of cognitive science (Koller et al., 2022; Zhang et al., 2021; Zhang and Cueto, 2017). Specifically, entrepreneurs cognitively use effectual principles as *heuristics* – broadly cognitive strategies that ignore part of the information available to make fast and frugal decisions in specific situations (Gigerenzer and Gaissmaier, 2011; Zhang and Cueto, 2017). Heuristic decision-making contrasts with *optimizing*, which is a rational decision-making strategy that takes into consideration *all* information available to the decision-maker (Tversky and Kahneman, 1986). Causal principles can be seen as examples of optimizing, to predict the optimal course of action for achieving a long-term venture goal (Koller et al., 2022). Importantly, research on effectuation as heuristics has helped clarify when and why entrepreneurs use effectuation (Grégoire and Cherchem, 2020; Reymen et al., 2015). Specifically, this research emphasizes that entrepreneurs seek to achieve *decision- (or situation-) fit* – they align decision principles and logics with the specific decision-making situations they face. For instance, entrepreneurs use effectuation for decisions that are more complex and less costly to implement, whereas they use causation for decisions that are less complex and more costly to implement (Koller et al., 2022). Importantly, the insights on the cognitive underpinnings of effectuation as heuristics have not yet been integrated into the measurement of effectuation, which remains challenging (McKelvie et al., 2020).

### 2.2. Current measurement of effectuation and its limitations

Since Sarasvathy's (2001a) foundational paper outlining effectuation theory, empirical studies exploring effectuation, its antecedents, and outcomes have used a variety of measures to operationalize it. Process-based research into effectuation has typically relied on qualitative coding of effectuation and causation of data collected through think-aloud protocols and interviews with entrepreneurs (e.g., Dew et al., 2009a; Jiang and Ruling, 2019; Reymen et al., 2015). Nevertheless, as the field of effectuation advances toward a more mature stage of development (Grégoire and Cherchem, 2020; Perry et al., 2012), there has been an increase in the use of standardized questionnaire measures. We summarize existing questionnaire measures of effectuation in Table 1.

In terms of the assessment methods used to measure effectuation, most existing measures (see Table 1) have relied on self-report measures employing Likert scales to record the degree of agreement with items/statements.[3] The most used measures in the literature (Brettel et al., 2012; Chandler et al., 2011) present behavioral statements. For instance, entrepreneurs are asked to consider the start-up phase of their venture and to indicate the degree to which they agree or disagree with statements about past behaviors such as "We used pre-commitments from customers and suppliers" or "We experimented with different products and/or business models" (Chandler et al., 2011). Other measures have operationalized effectuation as a decision-making approach (i.e., individuals' or firms' preferred decision-making approach; an example item is "As the managers of this company, we consider it important that both we ourselves and our employees only invest what we can afford to lose" (Werhahn et al., 2015)).

While self-report measures offer many benefits (Lucas and Baird, 2006), they also suffer from limitations. Existing self-report measures of effectuation ask entrepreneurs to retrospectively recall how they behaved *across* situations and made decisions over a period spanning several months or years (e.g., the start-up phase of their venture) (e.g., Chandler et al., 2011). This creates two challenges for assessing effectuation as heuristics. Firstly, by aggregating past behaviors across many diverse situations (ranging from seeking funding, to hiring first employees, or allocating resources), self-report measures *cannot capture entrepreneurs' situation-specific use of effectuation*. This poses a threat to the accuracy of the assessments captured through self-report measures, because these assessments tell us only about entrepreneurs' general, dominant logics during venture creation. They fail to capture when and how entrepreneurs dynamically adapt their use of effectuation and causation to specific situations or decisions (that they may have already, or not yet, encountered) (Jiang and Tornikoski, 2019; Koller et al., 2022; Reymen et al., 2015).

Secondly, the retrospective nature of these self-report measures may result in *rationalized accounts* that are not accurate representations of the actual decision-making used by entrepreneurs at the time (Podsakoff et al., 2003; Schwenk, 1985). This may lead to an overreporting of causation and underreporting of effectuation. This is because, when respondents are asked to recall behavior and decisions retrospectively, they tend to attribute decisions to rational, goal-directed processes (Mintzberg et al., 1976) such as causation. In contrast, when decision-making processes are studied using concurrent methods (e.g., analysis of meeting transcripts; Anderson, 1983) there is evidence that decision-makers tend to use *implicit* cognitive processes, such as heuristics, intuitive cognition and effectuation.

Indeed, effectuation was initially researched using concurrent, real-time decision-making tasks and think-aloud protocols whereby highly experienced and successful (i.e. expert) entrepreneurs verbalized their thoughts as they made decisions real-time (Sarasvathy, 2001b; Sarasvathy, 2008). The benefits of such a 'concurrent' methodology for eliciting entrepreneurs' decision-making is summarized by Dew et al. (2009a): "While retrospective recall allows subjects to make up good stories about how they believe they solve problems, and stimulus–response methods force us to deduce subjects' decision processes after the fact, concurrent verbalization allows the researcher to look directly inside the black box of cognitive processing […] (Ericsson and Simon, 1980). The validity of verbally reported thought sequences derives from its immediacy: the very short interval between the occurrence of thoughts and their

[3] We also note two scenario instruments developed in the effectuation literature. For instance, in the measure developed by Wiltbank et al. (2009), respondents are presented with a scenario describing a wearable computing business and are asked to indicate their approach to undertaking various business-related tasks. This measure only assesses the overall logics of prediction and control in investors' decision-making (constructs closely related to effectuation) and does not assess the *principles* associated with effectuation (e.g., focus on means). Koller et al. (2022) also report the development of a scenario instrument which experimentally manipulates different aspects of decision structure and assesses entrepreneurs' use of effectuation and causation (not their principles) in response to these structures. This instrument was developed as an experimental stimulus, *not* as a measure of effectuation.

**Table 1**
Summary of effectuation questionnaire measures (adapted and updated from McKelvie et al., 2020).

| Citation | Journal | Type of measure | Constructs measured | Conceptualization | Unit of analysis | Level of analysis | Number of items | Example item |
|---|---|---|---|---|---|---|---|---|
| (Alsos et al., 2014) | AOM Proceedings | Self-report, Likert scale | Five principles of effectuation (Means orientation, Affordable loss, Contingencies, Pre-commitment, Control) and five principles of causation (Ends orientation, Expected return, Pre-existing knowledge, Competitive analysis, Prediction) | Behavior | Firm | Firm | 10 | We develop the business based on the resources that we have available, without any clear vision of what the business will become in the end. |
| (Brettel et al., 2012) | JBV | Forced choice, Likert scale measuring "the *degree* of differences between two extremes" (p. 175) There have been adaptations splitting the effectuation and causation scales (i.e. they are being measured independently, see da Costa and Brettel, 2011) | Four contrasting principles: Preference for means vs. goals, Preference for affordable loss vs. expected returns, Preference for partnerships vs. competitive market analysis, Preference for acknowledge vs. overcome the unexpected. | Approach | R&D project (there have been adaptations to the new venture context, see Appelhoff et al., 2016) | Firm | 23 | Considerations about potential losses were decisive for the selection of the R&D option. |
| (Chandler et al., 2011) | JBV | Self-report, Likert scale | Causation, Experimentation, Affordable loss, Flexibility, Pre-commitments | Behavior | Firm | Firm | 20 | We have allowed the business to evolve as opportunities have emerged. |
| (Dwivedi and Weerawardena, 2018) | JBR | Self-report, Likert scale | Effectuation | Approach | Firm | Firm | 5 | We believe in undertaking pilot projects before fully implementing new programs. |
| (Gabrielsson and Politis, 2011) | SBE | Self-report, Likert scale | Effectuation and causation | Approach | Individual | Individual | 8 | I prefer accidental and informal relationships with my stakeholders. |
| (Koller et al., 2022) | JBV | Scenario instrument; Experimental stimulus | Effectuation and causation | Decision-making | Decision | Individual | 8 | Assess available resources, as well as what you would be willing and could afford to lose in case things go wrong; attempt to partner with a stakeholder who would be willing to share the risks |
| (Martín-Navarro et al., 2021) | IJME | Self-report, Likert scale | Means, Partnership, Affordable Loss, Contingency, Control, Causation | Approach | Individual | Individual | 25 | I use my personal knowledge and experience in the best possible way. |
| (Qureshi and Mahdi, 2014) | BR | Self-report, Likert scale | Effectuation | Approach | Individual | Individual | 11 | I take surprises positively and try to take benefit from them. |
| (Roach et al., 2016) | EJIM | Self-report, Likert scale | Means, Leverage contingency, Partnership, Affordable loss | Behavior | Firm | Firm | 13 | We experiment with different innovation concepts, rather than locking in too early in the process. |
| (Werhahn et al., 2015) | EMJ | Self-report, Likert scale | Means, Partnership, Affordable loss, Contingency, Control | Approach | Firm | Firm | 18 | As the managers of this company, we consider it important that both we ourselves and our employees use our personal knowledge and experience in the best possible way. |
| (Wiltbank et al., 2009) | JBV | Scenario instrument | Prediction and control | Decision-making | Decision | Individual | 14 | As you develop a marketing approach for this product you will: imagine possible courses of action based on your prior experience. |

verbalization. Therefore the concurrent verbalization technique suffers little from retrospection and introspection biases." (p. 294).

Research on effectuation using these concurrent methods has consistently shown that effectuation is an implicit, intuitive logic that develops through experience and expertise (Read and Sarasvathy, 2005; Wiltbank et al., 2009). Entrepreneurs who use effectuation tend to make decisions more holistically, using intuition and simplifying rules (i.e. heuristics) for dealing with complex problems they encounter during venture creation (Dew et al., 2009a). This makes effectuation difficult to consciously access, recall, and self-report on, because decision-makers are mostly unaware of their use of heuristics (Gigerenzer, 2007; Todd et al., 2012).

In sum, there are two key limitations of self-report measures of effectuation. They cannot assess entrepreneurs' situation-specific use of effectuation as heuristics, and they are likely to lead to entrepreneurs overreporting rational, causal logics and underreporting implicit, effectual logics due to their retrospective nature.

### 2.3. SJTs as a valid and predictive alternative to self-report assessments

To address these limitations and advance the measurement of effectuation (McKelvie et al., 2020) grounded in the cognitive sciences (Koller et al., 2022; Zhang et al., 2021; Zhang and Cueto, 2017), we propose a new assessment methodology that can capture entrepreneurs' implicit use of effectuation as heuristics in response to specific situations: the SJT.

SJTs (Motowidlo et al., 1990; Weekley et al., 2015) assess respondents' judgment and decision-making in specific situations (Christian et al., 2010). They consist of scenarios describing a situation in detail along with multiple response options presenting alternative logics for making a decision in that specific situation. Based on the behavioral consistency principle, it is expected that respondents' answers to the SJT mirror or simulate their decision-making in real-life situations (Wernimont and Campbell, 1968). SJTs are also referred to as *low-fidelity simulations*, as they mimic a real-life situation and elicit responses without the need for respondents to actually carry out the decisions sampled by the assessment (Motowidlo et al., 1990). SJTs capture real-time decisions in a more direct way compared to self-reports, and are thus better able to assess cognitions that rely on implicit processes (e.g., intuition, heuristics) which are difficult to access through recall (Brooks and Highhouse, 2005; Gigerenzer, 2007).

The SJT methodology is common and widely accepted in the applied psychology literature (Kepes et al., 2024; Weekley et al., 2015).[4] SJTs show high construct validity, demonstrating both convergent and discriminant validity with self-report measures of the same or theoretically related constructs (Arthur et al., 2014; Arthur and Villado, 2008; Bledow and Frese, 2009). Thus, there is some theoretical overlap between constructs measured using self-report methods and SJTs, but critically SJTs explain unique variance beyond self-reports (Freudenstein et al., 2020; Schäpers et al., 2020). This is because of the situation specificity of SJTs. Whereas self-reports capture respondents' aggregated, average behaviors across many different situations, SJTs assess an individual's preference for a particular approach under a given situation (and hold this situation constant across respondents) (Lievens, 2017a; Rockstuhl and Lievens, 2021). Moreover, SJTs directly capture respondents' real-time, implicit cognitions in response to simulated situations (Motowidlo et al., 2006), whereas self-reports capture perceptions of past behaviors shaped by consequences experienced and outsider reactions (Kahneman et al., 2004; Schwenk, 1985).

SJTs differ in whether they are designed to assess broader performance in a particular work context (Chan and Schmitt, 2002; Motowidlo and Tippins, 1993) or specific constructs, so-called construct-based SJTs (Bledow and Frese, 2009; Olaru et al., 2019). For construct-based SJTs, researchers typically use theory to develop the scenarios and response options (Guenole et al., 2017; Lievens, 2017b). Importantly, SJTs are particularly suitable for the measurement of *situated* constructs–which are constructs that are difficult to disentangle from the situation in which they are being used (Bledow and Frese, 2009; Suchman, 1987). Situated constructs are cognitions or behaviors which reflect how individuals respond to the constraints and opportunities presented by specific situations (Mischel, 2004; Mischel and Shoda, 1995). SJTs assess situated constructs by presenting simulated situations and assessing how likely individuals are to think or act in ways that align with that construct (Motowidlo et al., 2006). Examples of construct-based SJTs from the applied psychology literature include unethical decision-making (Kligyte et al., 2013; Mumford et al., 2006), personal initiative (Bledow and Frese, 2009), emotion regulation (Koschmieder and Neubauer, 2021), and personality (Olaru et al., 2019; Oostrom et al., 2019). SJTs in entrepreneurship are extremely rare. Two exceptions are an SJT to assess the cultural orientations of business owners (König et al., 2010; König et al., 2007) and for practical intelligence, a construct related to intuition and expertise (Baum et al., 2011).

Extant research has also demonstrated the criterion-related validity of SJTs. SJTs have mostly been developed and validated within the applied (I/O) psychology literature against employees' job performance as an outcome criterion. Importantly, meta-analytical studies of SJTs' criterion-related validities estimate that overall as a method, SJTs predict job performance (Christian et al., 2010; McDaniel et al., 2001) *over and above* self-report measures (Chan and Schmitt, 2002; Clevenger et al., 2001). The reasons for this stronger validity lie in SJTs' ability to capture cognition/behaviors occurring in specific situations, i.e. they have higher fidelity and map more closely to the situational requirements in which individuals perform their jobs (Mischel and Shoda, 1995; Weekley et al., 2015). Thus, SJTs better capture the full range of a construct in a more nuanced way compared to self-report measures which ask respondents to mentally aggregate and average their typical behavior/decisions across many different situations (Lievens, 2017a). Recent evidence suggests that as the specificity of the situations presented as part of the SJTs increases, their predictive validity for performance also increases (Rockstuhl and Lievens, 2021; Schäpers et al., 2020). In sum, SJTs are a valid and widely used assessment methodology that has been shown to have both high construct validity, as well as high criterion-related validity. Furthermore, SJTs assess unique variance (that contributes significantly to the prediction of performance outcomes) compared to and above self-report

[4] SJTs are also commonly used in practice. For instance, the UK Government assesses candidates for civil service positions using a Civil Service SJT (UK Government, 2024).

measures of the same constructs.

### 2.4. An SJT for measuring effectuation as heuristics

We propose that an SJT is especially well suited for capturing the implicit cognitive processes underpinning entrepreneurs' situation-specific use of effectuation as heuristics. SJT theories highlight that this assessment method requires first assessing the situational cues the SJT presents, and second accessing past experience of dealing with similar situations, as well as procedural knowledge about the effectiveness of different logics (Martin-Raugh and Kell, 2021). This focus on concurrent, situation-specific judgment favors more implicit, intuitive logics compared to rational, optimizing logics (Brooks and Highhouse, 2005; Motowidlo et al., 2006). Thus, we propose that compared to existing self-report assessments of effectuation, an SJT assessment would enable us to more accurately capture and understand the prevalence of effectuation in entrepreneurial decision-making.

Furthermore, SJT's focus on assessing situated constructs makes it an ideal method for capturing entrepreneurs' situation-specific use of effectual principles (i.e., the notion of decision- and situation-fit). By simulating decisions or situations that entrepreneurs are likely to encounter at different stages of the venture creation process, SJTs can capture the situational dynamics which trigger entrepreneurs to switch between effectual and causal logics in the new venture creation process. Recall, that entrepreneurs switch between logics depending on the characteristics of the situations they encounter, such as uncertainty and resource scarcity (Jiang and Tornikoski, 2019; Reymen et al., 2015). Furthermore, SJTs can also capture how entrepreneurs use effectual principles to align with specific decisions in new venture creation and what they are about. For instance, because SJTs present specific decisions, they can assess how entrepreneurs prioritize affordable loss for resource allocation decisions, or co-creation for stakeholder decisions (Koller et al., 2022).

Lastly, a new SJT of effectuation has the potential of improving the predictive validity of effectuation for venture performance, because of SJTs' emphasis on entrepreneurs' situation-specific use of effectuation. This is in line with the substantive, extant evidence on the criterion-related validity of SJTs for job performance (Christian et al., 2010; McDaniel et al., 2001), and with recent evidence on 'decision-fit', i.e. situation-specific use of effectuation principles (Koller et al., 2022). Thus, a SJT measure of effectuation might help address calls for better understanding and exploring the predictive validity of effectuation for venture outcomes (Arend et al., 2015; Grégoire and Cherchem, 2020), which past self-report effectuation measures have struggled with (see McKelvie et al., 2020 for a review).

### 2.5. Exploring the construct and predictive validity of a new SJT of effectuation

To establish the construct validity of our SJT measure, we investigate its convergent and discriminant validity. We investigate its relationship with measures of effectual behaviors captured through self-reports (Chandler et al., 2011). While we expect matched constructs from both the SJT and self-report measures to be positively related (showing evidence of convergent validity), we anticipate only small to moderate-sized relationships given the conceptual differences in the constructs (situation-specific use of heuristics in the SJT vs. generalized behavioral tendencies in self-reports) assessed by these measures (discriminant validity). This is in line with previous research on the relationship between theoretically matched constructs assessed by SJTs and self-report methods (Bledow and Frese, 2009; Lievens, 2017a).

One of the main criticisms of effectuation theory concerns its lack of theoretical clarity regarding how effectuation relates to venture outcomes (Arend et al., 2015; Grégoire and Cherchem, 2020). Specifically, our newly developed SJT can aid a better understanding of how effectuation predicts venture outcomes and thereby would help to advance effectuation theory. To assess the predictive, criterion-related validity of our SJT, we explore the relationship between effectuation measured by the SJT and several theoretically relevant venture outcomes. The evidence on the predictive validity of effectuation is limited (Grégoire and Cherchem, 2020). Furthermore, past empirical research examining the relationship between effectuation and venture outcomes has focused on the overall construct of effectuation, rather than its principles (e.g., Deligianni et al., 2017; Smolka et al., 2018). In our paper, we chose to focus on effectual principles (in line with our 'effectuation as heuristics' theoretical stance) and on three key venture outcomes, theorized to be related to effectuation and causation in the literature (Read et al., 2009; Sarasvathy, 2024, Sarasvathy, 2008; Sarasvathy, 2001a): *venture progress* as an indicator of performance in the early stages of creation of a new venture*, venture expenses* as a proxy for resources used*,* and *venture funding* as a key milestone in the venture creation process which has so far been predominantly associated with causation (Kirsch et al., 2009; Latifi et al., 2024).

As a more proximal outcome than venture performance, *venture progress* has been defined as the extent to which an entrepreneur has made successful attempts in advancing or moving the business venture forward (Gielnik et al., 2015; Uy et al., 2015). Past research on the antecedents of venture progress has suggested individual differences in self-efficacy (Uy et al., 2024), as well as behaviors such as venture effort (Gielnik et al., 2015) and feedback-seeking (Uy et al., 2024) play a key role. We argue that effectuation as measured by the SJT should positively relate to venture progress, as entrepreneurs who focus on their given means, co-create with self-selected stakeholders, and leverage unexpected developments are able to navigate the early stages of creation despite challenges documented in the literature such as high levels of uncertainty and restricted access to resources (Sarasvathy, 2024; Sarasvathy, 2008; Wiltbank et al., 2006). We also expect causation measured by the SJT to positively relate to venture progress as this logic may help entrepreneurs formulate goals, gather information related to their venture's plans and the environment in which they operate, and better predict and prepare for future challenges (Brinckmann et al., 2010; Delmar and Shane, 2003; Gruber, 2007).

Past research on effectuation has linked effectuation and causation to positive performance outcomes (Read et al., 2009; Smolka et al., 2018); this means that our understanding of the costs related to their use is limited. We explore the relationship between

effectuation and causation as measured by the SJT and a measure of resource use, specifically *venture expenses*. We expect that causation will be related to higher venture expenses, as entrepreneurs will be seeking to maximize returns through significant expenses and will invest resources in line with their long-term growth goals (Brinckmann et al., 2010; Delmar and Shane, 2003). Furthermore, whereas we expect that certain effectual principles such as affordable loss may be negatively related to expenses, other principles such as leverage contingencies may be positively related to expenses as entrepreneurs use resources to pursue multiple opportunities.

Finally, research on *venture funding* has mostly focused on the role of the business planning approach (Kirsch et al., 2009)—a construct related to causation. This means our understanding of the relationship between effectuation and funding is limited. Past research on investor decision-making has shown that entrepreneurs using effectuation may be more likely to receive investment, especially when the investors themselves use effectuation (Murnieks et al., 2011; Wiltbank et al., 2009). Particularly, entrepreneurs who focus on leveraging existing means such as past experience are more likely to receive investment (Mitteness et al., 2012). Thus, we expect that certain effectual principles, such as focus on means, may be positively related to the amount of external funding ventures receive. The leverage contingencies principle may also be positively related to venture funding as investors value entrepreneurs who are adaptable and respond to environmental changes (Warnick et al., 2018). While we theorize some expected relationships between certain effectual principles and causal logics and venture outcomes, we report relationships for all principles and logics in the spirit of exploration.

## 3. Method and results

### 3.1. Overview of studies

Building on the methodology used by past studies to develop and validate measures for entrepreneurship research (Cardon et al., 2013; Chandler et al., 2011; Davidsson et al., 2021; Michaelis et al., 2020), as well as best practices in the development of SJTs (Bledow and Frese, 2009; Guenole et al., 2017; Motowidlo et al., 1990), we followed a three-step procedure to develop, refine, and test the validity of the SJT. Firstly, we developed the SJT and conducted three pilot studies to assess content validity and adjust wording to improve respondents' comprehension of the items. In Study 1, we explored the reliability and factor structure of the SJT. In Study 2, we refined some of the response options of the SJT. In Study 3, we test our SJT using alternative referents comparing scenarios written in a 1st and 3rd person referent. In Study 4, we confirmed the SJT's factor structure, examined its convergent and discriminant validity with a widely used, self-report measure of effectuation (Chandler et al., 2011) and its predictive, criterion-related validity for venture outcomes.

### 3.2. Scale development: Three pilot studies

Following guidelines for developing SJTs (Bledow and Frese, 2009; Motowidlo et al., 1990) and to ensure the scenarios are ecologically valid, we conducted 41 semi-structured interviews with entrepreneurs. These helped us collect critical incidents of the typical decisions entrepreneurs encounter during the new venture creation process. Participants were asked to provide a dated timeline of the development of their venture and note the most significant decisions they made. The interviewer (the first author) probed each decision using questions designed to elicit discussion of decision-making processes (e.g., "Walk me through the thought process you went through when you made this decision"; "Can you tell me more about the options you considered as part of your decision-making?"). Interviews lasted on average an hour, and each participant discussed four to five decisions.

The interviews helped us develop the decision scenarios and response options for each decision. We first coded the content category of the decision (e.g., hiring, investment, growth), and devised a list of the most commonly occurring decisions across participants. Second, we coded instances where the logics described by the entrepreneurs were consistent with effectuation or causation. Thus, we employed a theory-led, abductive coding process guided by Sarasvathy's (2001a) conceptualization of effectuation and causation while using inductive examples of real-life decisions that entrepreneurs typically encounter. This is the approach typically followed for developing construct-based SJTs (Bledow and Frese, 2009; Guenole et al., 2017). We also cross-checked the inductively derived decisions against past inductive and process studies of venture creation (Koller et al., 2022; Reymen et al., 2015) and found sufficient coverage, ensuring no new decisions emerged.

Similar to Wiltbank et al. (2009), we wrote an overall description of a venture developing products using virtual reality technology (see Appendix A). This included information about the fictitious entrepreneur (Allison) creating the venture and the resources available for the venture. Based on the critical incidents collected, we then developed 21 decision scenarios targeting different decisions the entrepreneur would face, such as choosing a product idea to turn into a prototype, forming a team, or marketing the venture's offering. Following best practices in SJT and scale development (Bledow and Frese, 2009; DeVellis, 2017; Motowidlo et al., 1990), we started with a wide range of decisions that could capture respondents' situation-specific use of effectuation and causation. Each decision scenario was construct-agnostic, meaning that the scenario only described the situation in which either effectuation or causation (or both) may be used by the respondent. In total, we developed 21 decision scenarios at this stage based on the critical incidents collected during the interviews with entrepreneurs.

Importantly, in line with best practices on scale development (DeVellis, 2017), we proceeded to elaborate conceptual definitions for each of our measured constructs (namely, the four effectual and four causal principles) (MacKenzie et al., 2011; Podsakoff et al., 2016), in line with past literature on effectuation (Sarasvathy, 2008; Sarasvathy, 2001a; Sarasvathy and Dew, 2005). Upon developing these conceptual definitions, we identified *six* independent constructs relating to entrepreneurs' Focus on Means, Affordable Loss, Co-Creation (effectual principles), Prediction, Maximize Returns, and Competitiveness (causal principles). These principles did not

refer to different levels of the same construct, and could, in theory, be simultaneously used by entrepreneurs in their decision-making. However, we also identified that two principles, namely Avoid and Leverage Contingencies were *not* independent constructs, and instead refer to different levels of the same construct: entrepreneurs cannot simultaneously avoid *and* leverage contingencies, they can *either* avoid *or* leverage contingencies.[5] This indicates that these two principles should be assessed using one (rather than two) scales. Thus, we slightly departed from Sarasvathy's (2001a) conceptualization of eight principles (four for effectuation, four for causation) by considering the Avoid and Leverage Contingencies principles as different ends of one scale, where lower scores reflect the principle of avoiding contingencies and higher scores reflect leveraging contingencies.

For each decision scenario, we proceeded to develop response options reflecting effectual and causal principles using our conceptual definitions. Best practices for developing construct-based SJTs recommend that each response option should be unidimensional (Bledow and Frese, 2009; Guenole et al., 2017). Thus, each response option assessed only one construct, while the decision scenario itself described a situation relevant to multiple constructs. When developing the response options, we used coded excerpts from the interviews representing exemplars of effectual and causal principles to stay as close as possible to the language employed by entrepreneurs (Motowidlo et al., 1990). In total, we developed 101 response options at this stage, with three to seven response options[6] for each decision scenario. An example of a decision scenario and the corresponding response options is as follows:

*Allison needs to start making decisions around how to market her product. How would you approach it?*

a) *Rely on marketing methods that you, your team, or wider network are familiar with*
b) *Devise a detailed marketing plan based on systematic customer segmentation and market research*
c) *Experiment with different marketing methods*
d) *Limit spending on marketing to sums of money that would not put the venture in real trouble financially if they were lost*

Having developed an initial set of response options, we investigated the content validity of these options in relation to effectuation theory (Sarasvathy, 2008; Sarasvathy, 2001a) using a modified Q-sort approach (Nag et al., 2007; Stephenson, 1953) in a second pilot study. We engaged six active, PhD-holding researchers in the effectuation field. As a first step, respondents categorized each option into an effectual or causal logic. As a second step, the respondents categorized all the options into one of the seven principles outlined above. Respondents could choose not to categorize the options in either of the two logics or in any of the principles. They completed the Q-sort task and provided qualitative feedback on the response options. We used the results of this study to modify and reword several response options to ensure they assessed the theoretical constructs of effectuation and causation in line with our conceptual definitions (and past literature). We conducted a third pilot study with 10 entrepreneurs to assess whether respondents encountered any difficulties in comprehending the decision scenarios and response options. We made minor edits to the response options based on this final pilot study (no response options were removed at this stage, following best practice recommendations that larger initial sets of items are better; DeVellis, 2017).

### 3.3. Study 1

#### 3.3.1. Participants and procedure

We surveyed 205 owner-managers of businesses in the United Kingdom, thus meeting the definition of "everyday entrepreneurs" (Welter et al., 2017). We used Prolific, an established platform for online participant recruitment commonly used by researchers in entrepreneurship[7] (Nguyen et al., 2024; Zunino et al., 2022). Participants were offered a standard rate of £7.50/h for completing the questionnaire. Entrepreneurs in our sample were 52 % female (106 females), had a mean age of 39.65 years (SD = 12.09), 59.5 % had university-level education, had an average of 17.51 years (SD = 11.82) of work experience, had founded an average of 1.60 ventures (SD = 1.09, min = 1, max = 10), and had 7.89 years (SD = 7.47, min = 0, max = 38) of entrepreneurial experience. Participants' businesses ranged from 0 to 40 years old, had annual business revenues of between 0 and £3,000,000, and employed an average of 3.12 employees (SD = 7.94).

#### 3.3.2. SJT measure

Participants read the description of the fictitious venture and were asked to put themselves in the shoes of the entrepreneur as they made a series of decisions about the venture (i.e., the decision scenarios). Each response option represented either a causal or effectual principle based on Sarasvathy's (2001a) conceptualization. Response formats for SJTs vary, either (a) asking respondents to choose the

[5] This also poses conceptual problems given past research findings showing that effectual and causal principles can be used as part of hybrid decision-making (Koller et al., 2022; Reymen et al., 2015).

[6] Given the domain-specificity of effectual principles (e.g., affordable loss and maximize returns are used for resource investment decisions; co-creation and competitiveness are used for stakeholder decisions; Koller et al. (2022)), not all decision scenarios could elicit all principles. Our goal was to keep the decision scenarios and response options as credible and realistic as possible, in line with the literature on the importance of situational specificity in the development of SJTs (Rockstuhl and Lievens, 2021; Schäpers et al., 2020).

[7] In order to screen for inattentive responses, we incorporated two attention check items in the survey and we removed data from two participants who failed one of these checks (there were no participants in our sample who failed both checks). We also used a response speed cut-off based on recent research on data quality on online platforms (Douglas et al., 2023; Wood et al., 2017) and removed data from four participants who spent less than 5 min responding to the survey (this was the fastest the survey could be completed whilst reading all the information presented).

response options they are most (and least) likely to use, (b) to rate each response option using Likert-type scales, or (c) to rank each of the options from most to least likely (McDaniel and Nguyen, 2001). Likert-type rating scales of individual response options tend to show better measurement properties, including improved reliability compared to other response formats (Arthur et al., 2014; Catano et al., 2012; Weekley et al., 2015). Thus, we asked participants to rate each response option on a 5-point Likert rating scale (1 = Strongly Disagree to 5 = Strongly Agree). This format enables us to assess effectual and causal principles independently, rather than as opposites (the exception is leveraging contingencies as discussed in section 3.2). This format also allows to capture entrepreneurs' use of *hybrid* logics i.e. combining effectuation and causation (Koller et al., 2022; Reymen et al., 2015), because entrepreneurs could rate highly response options representing both effectual and causal principles for the same decision scenario.

#### 3.3.3. Data analysis

We used exploratory factor analysis (EFA) to investigate the dimensionality of the SJT. We used parallel analysis (Hayton et al., 2004) to decide on the number of factors to retain (Zwick and Velicer, 1986). We assessed the factorability of the data using option communalities (which should be above 0.50, Hair Jr. et al., 2006), Bartlett's test of sphericity (which should be significant, Bartlett, 1950), and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (which should be above 0.50, Kaiser, 1970). Each of the response options exceeded the communality cut-off value of 0.50. We found a KMO value of 0.75 and a significant Bartlett's test ($\chi^2$ = 10,682.73, $p < .001$), indicating that factor analysis was appropriate. We used both orthogonal and oblique rotations to aid in the interpretation of the factors obtained, and the results were similar using both rotation approaches. We report the factor loadings obtained using orthogonal rotation in the subsequent results section.

#### 3.3.4. Results

The results of the parallel analysis suggested that seven factors should be retained. However, upon inspecting the factors resulting from the EFA, we discovered that only five factors corresponded to effectual and causal principles, while the remaining two factors were not interpretable with reference to effectuation or causation constructs.[8] We removed the 10 response options that loaded on the two uninterpretable factors and reran the parallel analysis, which then indicated that five factors should be retained. We further removed 40 response options that loaded significantly (> 0.40, Hair Jr. et al., 2006) on more than one factor or had factor loadings below 0.40, leaving us with 51 response options across 15 decision scenarios. Similar to the factor structure reported by Chandler et al. (2011), the response options reflecting causal principles loaded together on one Causation factor (22 response options, α = 0.91), whereas options reflecting the four effectuation principles loaded on separate factors: Focus on Means (6 response options, α = 0.68), Affordable Loss (7 response options, α = 0.58), Co-Creation (10 response options, α = 0.77), and Leverage Contingencies (6 response options, α = 0.76). All response options had factor loadings above 0.40, indicating appropriate fit and power (Hair Jr. et al., 2006). The decision scenarios, response options and their factor loadings in Study 1 can be found in Appendix Table 1.

### 3.4. Study 2

In Study 2, we aimed to re-test and refine our SJT measure (specifically response options for Focus on Means and Affordable Loss).

#### 3.4.1. Participants and procedure

Using the same sampling procedure as in Study 1, we collected data from an additional sample of 216[9] owner-managers of businesses in the UK. The sample was 65 % female (140 females), had a mean age of 37.85 years (SD = 11.43), 62.5 % had university-level education, with an average of 15.59 years (SD = 10.54) of work experience, had founded 1.58 ventures (SD = 1.13, min = 1, max = 10), and had 7.47 years (SD = 6.88, min = 0, max = 40) of entrepreneurial experience. Participants' businesses ranged from 0 to 29 years old, had annual business revenues between 0 and £7,000,000, and employed an average of 2.06 employees (SD = 7.97).

#### 3.4.2. Revised SJT measure

In the second iteration of the SJT, we retained 51 response options (across 15 decision scenarios) from the initial measure that displayed good psychometric properties and developed additional response options for the Focus on Means (3 options) and Affordable Loss (4 options) scales, i.e., the two scales that had Cronbach α reliabilities below 0.70 in Study 1.

[8] Our primary goal was to develop a new measure for a well-established and well-defined construct, namely effectuation and its principles (Sarasvathy, 2001b, Sarasvathy, 2001a; Sarasvathy, 2008). Given that the constructs of interest have been extensively studied and defined in the extant literature, we used a theoretical lens to interpret the factors extracted through the parallel analysis and EFA. Our interpretation of these two factors is that one factor was assessing prioritization and staying agile (e.g., Stay alert and avoid dismissing opportunities that may seem incompatible with your company's current vision; Choose countries that are most likely to yield the highest returns and growth) whereas the second factor contained a mix of items that were attributed by the experts in the Q sort exercise to different effectual and causal principles, that we could not interpret in light of effectuation. Thus, based on the empirical data we collected, these 10 items did not seem to accurately represent the theoretical construct of effectuation (or its principles), hence we decided to remove them at this stage (in line with our goal to reduce the number of items on the measure in the development process; DeVellis (2017)). In doing so, we follow best practices for the development of measures for *existing* theoretical constructs (Lambert and Newman, 2023).

[9] We followed a similar approach as in Study 1 to screen for inattentive responses. We removed data from one participant who failed both attention checks and from two participants who spent less than 4 min responding to the survey (this was the fastest the survey could be completed whilst reading all the information presented).

**Table 2**
Decision scenarios and response option loadings (Study 2).

| Decision Scenarios | Response Options | C | AL | CC | LC | FM |
|---|---|---|---|---|---|---|
| 1.Allison knows she can't build and grow this company alone, so she needs to assemble a team to help her get started with the new venture. | Seek co-founders who commit time and resources to shape the future vision of the company | | | 0.46 | | |
| 2. Allison is working on the specifications for her first product prototype. | Base prototype specifications on in-depth competitor analysis and positioning | 0.46 | | | | |
| | Be careful not to risk more money than you are willing to lose with your initial idea | | 0.62 | | | |
| 3. Allison is starting to think about the resources necessary for building an initial product prototype. | Build a detailed business plan and estimate the resources and costs associated with building the prototype | 0.66 | | | | |
| 4. Allison is trying to figure out how to manage and allocate the funds she has available to invest in her start-up. | Build a financial plan projecting budgets for the main functional areas of the business requiring investment | 0.56 | | | | |
| | Only spend what is absolutely necessary at this stage, save the remainder for a rainy day | | 0.49 | | | |
| 5. Now that Allison has developed specifications for her prototype, she needs to decide which set of technologies to engage in the development of her prototype's software. | Look for technology partners that can help you design and build the technology infrastructure | | | 0.59 | | |
| 6. Allison's team is starting development work for the prototype, so she has to organize and manage the team's workload. | Carefully plan the team's activities for the upcoming period | 0.59 | | | | |
| | Experiment with and trial different ways of organizing the workload among the team | | | | 0.54 | |
| 7. Allison is identifying and deciding between potential sources of revenue for her business, in particular whether to target enterprises or individual customers. | Evaluate expected returns from different sources of revenue | 0.47 | | | | |
| | Conduct detailed market analyses and use this data to decide which target customers you should focus on | 0.63 | | | | |
| | Base your decision on your and your team's previous experience and network | | | | | 0.74 |
| 8. Allison is deciding which production modality to use so she can start fulfilling customer orders. | Research alternatives and project the expected efficiencies for each production mode | 0.50 | | | | |
| | Base your decision on a consideration of your past experience and network | | | | | 0.65 |
| | Search for a key stakeholder who is willing to share the risks | | | 0.56 | | |
| 9. Allison is working on developing her company's branding. | Establish partnerships with reputable organizations and individuals to benefit off their brand | | | 0.66 | | |
| | Focus on highlighting key differentiators from your competition's offering through your branding | 0.42 | | | | |
| | Devise a clear, well-defined branding strategy based on data about your target customer and their preferences | 0.62 | | | | |
| | Be careful not to commit more resources in branding than you can afford to lose | | 0.75 | | | |
| 10. Allison needs to start making decisions around how to market her product. | Rely on marketing methods that you, your team, or wider network are familiar with | | | | | 0.80 |
| | Devise a detailed marketing plan based on systematic customer segmentation and market research | 0.71 | | | | |
| | Experiment with different marketing methods | | | | 0.78 | |
| | Limit spending on marketing to sums of money that would not put the venture in real trouble financially if they were lost | | 0.77 | | | |
| 11. Allison is working on getting her company's sales efforts off the ground. | Experiment with different sales methods | | | | 0.76 | |
| | Evaluate different sales strategies based on calculations of expected returns | 0.51 | | | | |
| | Devise a detailed strategy outlining sales targets and plans on how to achieve these targets | 0.71 | | | | |
| | Research your competitors' sales strategies and look for a strategy that will allow you to build competitive advantage over them | 0.55 | | | | |
| | Choose sales methods and channels that you or your team have previous experience with | | | | | 0.65 |
| 12. Allison starts thinking about identifying and creating new business opportunities for her company. | Develop a detailed plan for business development activities and set clear performance targets | 0.73 | | | | |

(*continued on next page*)

**Table 2** (*continued*)

| Decision Scenarios | Response Options | C | AL | CC | LC | FM |
|---|---|---|---|---|---|---|
| | Calculate and evaluate expected returns from various opportunities to decide which ones to focus on | 0.47 | | | | |
| | Partner up with organizations targeting similar customers and create business opportunities together | | | 0.74 | | |
| | Limit your investment of resources into business development to what you can afford to lose in a worst case scenario | | 0.74 | | | |
| 13. Allison is designing processes intended to facilitate entry into new geographical markets. | Co-opt local partners who can help you figure out local conditions and share the risks of expansion | | | 0.70 | | |
| | Experiment with various approaches in the local market | | | | 0.70 | |
| | Conduct in-depth research of local market conditions and plan a clear strategy | 0.66 | | | | |
| | Only spend as many resources as you could afford to lose if things didn't work out | | 0.82 | | | |
| 14. Allison needs to come up with some product ideas that would enable her to diversify her venture's offering. | Study expert predictions of where the market is heading to get ideas for expansion | 0.58 | | | | |
| | Establish partnerships that enable you to develop new products or services | | | 0.67 | | |
| | Experiment with different product ideas before deciding on a direction to pursue | | | | 0.67 | |
| | Produce calculations of potential returns for different ideas for products and services | 0.63 | | | | |

*Note.* C = Causation, AL = Affordable Loss, CC = Co-creation, LC = Leverage Contingencies, FM = Focus on Means. Factor loadings <0.40 were omitted from the table.

**Table 3**
Paired sample *t*-tests comparing scores on 3rd and 1st person SJT.

| | Mean SJT 3rd person | Mean SJT 1st person | *t* | Two-sided *p* |
|---|---|---|---|---|
| Affordable Loss | 4.02 | 3.98 | −0.92 | 0.36 |
| Co-Creation | 3.78 | 3.77 | −0.41 | 0.68 |
| Leverage contingencies | 3.71 | 3.71 | 0.05 | 0.96 |
| Focus on means | 3.75 | 3.72 | −0.71 | 0.48 |
| Causation | 4.12 | 4.11 | −0.66 | 0.51 |

*Note.* $n = 208$.

### 3.4.3. Data analysis

Each of the response options exceeded the communality cut-off value of 0.50. We found a KMO value of 0.78 and a significant Bartlett's test ($\chi^2 = 4848.75$, $p < .001$), indicating that factor analysis was appropriate. We followed the same EFA procedures described in Study 1. Additionally, we used confirmatory factor analysis (CFA) to assess the presence of common method bias (Williams et al., 2010) and followed best practices by using blue attitude as a marker variable (Simmering et al., 2015). We did not find any evidence of common method variance bias (see Appendix B for details of this analysis). We conducted our CFA analyses using AMOS 27 and Maximum Likelihood Estimation procedures. We used SPSS 27 for all other analyses.

### 3.4.4. Results

The results of the parallel analysis for the revised set of response options suggested that five factors should be retained. We removed 18 response options with factor loadings below 0.40 or that cross-loaded (>0.40) on more than one factor. The resulting scales derived from the EFA were Causation (18 response options, $\alpha = 0.89$), Focus on Means (4 response options, $\alpha = 0.72$), Affordable Loss (6 response options, $\alpha = 0.80$), Co-Creation (7 response options, $\alpha = 0.75$), and Leverage Contingencies (5 response options, $\alpha = 0.76$). Thus, the revised scales show good reliability. The factor loadings for the 40 response options across 14 decision scenarios in the final version of the measure are presented in Table 2.

## 3.5. Study 3

We conduct Study 3 to compare scenarios written in a 1st and 3rd person referent for our SJT. Our SJT asks entrepreneurs to put themselves in Allison's shoes (3rd person referent) as they respond to a series of fictitious decision scenarios. Whereas the decision scenarios are phrased using a 3rd person referent (Allison), the response prompt ("How would you approach it?") and the response options are phrased using a 1st person referent. Nevertheless, there is a possibility that respondents perceived our instrument as giving advice to Allison (the fictitious entrepreneur described in the scenario), instead of reporting on how they would make decisions in the

simulated decisions.[10]

We conducted study 3 using the Prolific platform where we asked 208[11] entrepreneurs to complete the final, validated version of our SJT (presented in Table 2; 3rd person referent) and an equivalent form of the SJT employing a 1st person referent in the decision scenarios (e.g., "You are the founder and CEO of a start-up", "You are working on developing your company's branding"). As discussed above, the response options remained unchanged given they were already using a 1st person referent. We presented the two forms of the SJT in a randomized order to rule out potential order effects.

We conducted paired-samples t-tests to examine whether there were any significant differences in scores across the five scales computed on the SJT between the two forms. As seen in Table 3, there were no significant differences in scores between the two SJT forms, suggesting equivalence between the SJTs using alternative referents. These results indicate that entrepreneurs' responses were not influenced by the 3rd person referent used in the venture and decision scenarios, and thus further corroborate the construct validity of our SJT. We prefer the original 3rd person referent SJT in keeping with established construct-based SJTs in the applied psychology literature (e.g., MacCann and Roberts, 2008; Persich and Robinson, 2020).

### 3.6. Study 4

In Study 4, we had three main aims: to confirm the factor structure of our newly developed measure using an independent sample (Lambert and Newman, 2023), to investigate the concurrent, convergent and discriminant validity of the SJT with a self-report measure of effectuation (Chandler et al., 2011), and to assess the predictive, criterion-related validity of the SJT for several venture outcomes using a *prospective panel study design*.

#### 3.6.1. Participants and procedure

Data collection for Study 4 took place as part of a larger project aimed at understanding entrepreneurs' decision-making and behaviors during the COVID-19 pandemic. Data collection began in April 2020. We recruited entrepreneurs through personal contacts at organizations supporting entrepreneurs within the UK (e.g., accelerators, incubators, venture capital firms), online databases of entrepreneurs, and newsletters targeted at UK entrepreneurs. The sample consisted of owner-managers of businesses less than 5 years old at the start of the study, as new ventures are typically defined (Bird et al., 2012). Initially, 291 entrepreneurs expressed interest in participating, of which 176 completed the SJT and the self-report measure of effectuation (Chandler et al., 2011) (*t1*; 61 % response rate). We followed up with the cohort of entrepreneurs for *14 months*, at the end of which we collected data on several venture outcomes (*t2*). We obtained outcome data from 93 entrepreneurs (53 % retention).

Participants were between 19 and 64 years old (mean = 36.20, SD = 10.27); 58 % were female, and 74 % had a higher education degree. Entrepreneurs had between 0 and 22 years of entrepreneurial experience (mean = 4.65, SD = 4.28) and between 0 and 40 years of full-time work experience (mean = 13.92, SD = 9.72). Their current businesses ranged from 20 days to 5 years old. Most were founded by an individual entrepreneur (68 %; the remainder had between 1 and 5 co-founders), 54 % did not hire any employees at the start of the study (baseline mean = 1.97, SD = 4.71, max = 40), 71 % of entrepreneurs owned over 90 % equity in the business, and 23 % had received external financial investment for their business. The ventures operated in 18 different industries, with 15 % in Arts, Entertainment, and Recreation, 11 % in Professional, Scientific, and Technical Activities, 10 % in Information and Communication, and 9 % in Human Health and Social Work activities. Their mean revenues over the period of observation (14 months) were £97,389.82 (SD = 256,810.33) and their mean profits were £40,550.64 (SD = 153,907.38).

#### 3.6.2. Measures

*3.6.2.1. SJT of effectuation (t1).* We employed the refined SJT of effectuation described in Study 2. Reliabilities in Study 4 were: Causation (18 response options, α = 0.88), Affordable Loss (6 response options, α = 0.82), Leverage Contingencies (5 response options, α = 0.77), Co-Creation (7 response options, α = 0.68), and Focus on Means (4 response options, α = 0.70).

*3.6.2.2. Self-report measure of effectuation (t1).* To assess the convergent and discriminant validity of the newly developed SJT, we included the most widely used self-report measure of effectuation in entrepreneurship research (Chandler et al., 2011; McKelvie et al., 2020). This measure assesses an entrepreneurial team's overall use of effectual and causal behaviors across five scales. Participants indicated their level of agreement with each item using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). Causation is a 7-item scale (α = 0.80). Example items include "We designed and planned business strategies". Affordable Loss is a 3-item scale (α = 0.77). An example item is "We were careful not to commit more resources than we could afford to lose". Pre-commitments is a 2-item scale (α = 0.84). An example item is "We used pre-commitments from customers and suppliers as often as possible". The measure also includes two scales assessing separate components of the leverage contingencies principle. The experimentation scale contains 4 items (α = 0.69) and illustrates entrepreneurs' tendency to trial or test different approaches. It aligns with research on innovation in

[10] We thank an anonymous reviewer for highlighting this potential caveat of our instrument and for suggesting an empirical way of settling whether responses using the two alternative referents are equivalent.

[11] We followed a similar approach as in Studies 1 and 2 to screen for inattentive responses. We removed data from eight participants who failed one attention check (out of three) and one participant who failed two attention checks (no participants failed all three checks). No participants spent less than 6 min responding to the survey (this was the fastest the survey could be completed whilst reading all the information presented).

**Table 4**
Fit statistics for CFA models tested in Study 4.

| First-order models | $\chi^2$ | CFI | TLI | IFI | RMSEA |
|---|---|---|---|---|---|
| One-factor | 1778.15 | 0.47 | 0.44 | 0.48 | 0.09 |
| Two-factor | 1563.50 | 0.58 | 0.55 | 0.58 | 0.08 |
| Five-factor | 780.64 | 0.95 | 0.95 | 0.96 | 0.03 |

**Table 5**
Descriptive statistics, internal consistencies, and correlations for convergent and discriminant validity in Study 4.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Our SJT | | | | | | | | | | | | |
| 1. Causation logic | (0.88) | – | – | – | – | – | – | – | – | – | 3.98 | 0.46 |
| 2. Aff loss principle | 0.11 | (0.82) | – | – | – | – | – | – | – | – | 3.75 | 0.60 |
| 3. Contingencies principle | 0.23** | 0.09 | (0.77) | – | – | – | – | – | – | – | 3.83 | 0.65 |
| 4. Focus on means principle | 0.11 | 0.33** | 0.10 | (0.70) | – | – | – | – | – | – | 3.68 | 0.60 |
| 5. Co − creation principle | 0.20** | −0.08 | 0.19* | −0.11 | (0.68) | – | – | – | – | – | 3.70 | 0.49 |
| Chandler et al. (2011) measure | | | | | | | | | | | | |
| 6. Causation behaviors | **0.30**** | −0.02 | 0.05 | 0.04 | 0.20** | (0.80) | – | – | – | – | 3.43 | 0.68 |
| 7. Aff loss behaviors | 0.20** | **0.35*** | 0.02 | 0.07 | −0.05 | 0.15* | (0.77) | – | – | – | 4.18 | 0.65 |
| 8. Experimentation behaviors | −0.11 | 0.11 | **0.22**** | 0.07 | 0.06 | 0.28** | 0.09 | (0.69) | – | – | 2.80 | 0.81 |
| 9. Flexibility behaviors | 0.03 | −0.02 | **0.12** | 0.15 | 0.04 | 0.42** | 0.07 | 0.17* | (0.69) | – | 3.96 | 0.77 |
| 10. Pre − commitments behaviors | −0.16* | −0.06 | 0.12 | −0.08 | **0.37**** | 0.32** | −0.05 | 0.35** | 0.16* | (0.84) | 2.70 | 1.15 |

*Note*. Cronbach's α internal consistency estimates are placed on the diagonal in parentheses; $n = 176$. Correlations between matched principles are in bold (evidence of convergent validity). *$p < .05$, **$p < .01$.

established organizations (Brown and Eisenhardt, 1997) and frameworks such as the lean start-up approach (Ries, 2011; see discussion of differences between lean start-up and effectuation in Sarasvathy, 2024). An example item for experimentation is "We experimented with different products and/or business models". The flexibility scale contains 4 items (α = 0.69) and captures entrepreneurs' tendency to capitalize on and exploit unexpected contingencies that occur over time through a flexible approach (Chandler et al., 2011). An example item is "We allowed the business to evolve as opportunities emerged". This measure does *not* contain a scale assessing the Focus on Means principle.

*3.6.2.3. Venture outcomes (t2).* We assessed perceived *venture progress* using an adapted version of a measure of personal goal progress (Brunstein, 1993) tailored to the new venture context (Uy et al., 2015). The scale had 4 items (α = 0.87) rated on a 5-point Likert scale. An example item is "In the past 2 months, I have made a great deal of progress concerning my venture goal."

We also asked entrepreneurs to self-report their venture *expenses* and *external funding* received *over the past 2 months*. Entrepreneurs reported mean expenses of £17,797.37 (SD = 62,347.27), and mean funding of £111,648.04 (SD = 837,223) over the past 2 months. An investigation of skewness and kurtosis values, as well as histograms of these variables, indicated they were not normally distributed. Although it is standard practice to transform skewed variables, evidence suggests that skewed distributions of the dependent variable do not bias regression results (Knief and Forstmeier, 2021). Hence, we used the raw, untransformed values of these variables in our regression models.

*3.6.2.4. Control variables (t1).* We controlled for several characteristics of the entrepreneur and the venture that likely influence both their use of effectual and causal logics and venture outcomes. We controlled for demographic characteristics, including age, gender, and education of the entrepreneur, as proxies of human and social capital (Davidsson and Honig, 2003; Stam et al., 2014; Unger et al., 2011). We also controlled for overall entrepreneurial experience (in years), known to impact the use of effectuation and causation (Sarasvathy, 2001b), and venture performance (Toft-Kehler et al., 2014). Additionally, we controlled for business age and business size, which have been shown to relate to entrepreneurs' use of effectuation and causation (Berends et al., 2014; Reymen et al., 2015) and correlate with venture outcomes. Lastly, to capture the most salient feature of the environment, we included a measure of the perceived impact of COVID-19 on the entrepreneurs' ventures. Similar to Anwar et al. (2023), we asked entrepreneurs to rate the extent to which the COVID-19 pandemic impacted their venture (1 = Had a very significant NEGATIVE impact on my venture, 5 = My venture has not been impacted at all by the pandemic, 10 = Had a very significant POSITIVE impact on my venture). On average, entrepreneurs reported a slightly negative impact of COVID-19 on their venture (mean = 3.75, SD = 2.28).

### *3.6.3. Results*

*3.6.3.1. CFA.* To further investigate the factor structure of the SJT, we used CFA and, following suggestions by Byrne (2001), evaluated the fit of alternative measurement models. We analyzed several first-order models, comparing the fit for a single factor (Entrepreneurial Decision-Making), two factors (Effectuation and Causation), and five factors (Causation, Focus on Means, Affordable Loss, Co-Creation, Leverage Contingencies). This approach helps determine whether the principles of effectuation are empirically

**Table 6**
Descriptive statistics, internal consistencies, and correlations between variables for predictive validity in Study 4.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Age | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2. Sex | −0.10 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 3. E experience | 0.37** | 0.02 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 4. Business size | −0.02 | −0.07 | 0.13 | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 5. Business age (days) | 0.12 | −0.11 | 0.17 | 0.07 | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 6. Edu - Secondary | −0.01 | 0.08 | 0.21* | 0 | −0.03 | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 7. Edu - College | 0.01 | 0.11 | 0.05 | −0.13 | 0.09 | −0.15 | – | – | – | – | – | – | – | – | – | – | – | – |
| 8. Edu - Masters | −0.09 | 0.06 | −0.06 | 0.24* | −0.13 | −0.19 | −0.34 | – | – | – | – | – | – | – | – | – | – | – |
| 9. Edu - PhD | 0.17 | −0.16 | −0.15 | −0.08 | −0.03 | −0.09 | −0.17 | 0.22* | – | – | – | – | – | – | – | – | – | – |
| 10. Causation (SJT) | 0.08 | 0.01 | 0.10 | −0.04 | 0.13 | −0.15 | 0.20 | −0.05 | −0.04 | – | – | – | – | – | – | – | – | – |
| 11. Aff loss (SJT) | −0.02 | −0.02 | 0.06 | 0.11 | 0.39** | −0.14 | 0.11 | −0.04 | −0.09 | 0.12 | – | – | – | – | – | – | – | – |
| 12. Contingencies (SJT) | −0.15 | −0.22* | −0.01 | 0.04 | 0.00 | −0.18 | 0.00 | −0.15 | 0.10 | 0.31 | 0.09 | – | – | – | – | – | – | – |
| 13. Focus on means (SJT) | 0.03 | 0.03 | 0.10 | −0.05 | 0.10 | −0.14 | 0.25* | −0.11 | −0.15 | 0.25 | 0.33** | 0.01 | – | – | – | – | – | – |
| 14. Co-creation (SJT) | −0.07 | −0.01 | 0.00 | 0.16 | 0.00 | −0.19 | −0.03 | 0.07 | 0.00 | 0.25 | 0.03 | 0.26* | 0.01 | – | – | – | – | – |
| 15.COVID Impact | −0.03 | −0.20 | 0.04 | −0.05 | 0.00 | −0.08 | −0.12 | 0.11 | −0.01 | −0.10 | −0.12 | 0.24* | −0.12 | 0.02 | – | – | – | – |
| 16. Progress | 0.02 | −0.20 | 0.22* | 0.11 | 0.05 | −0.07 | −0.02 | 0.01 | 0.10 | 0.22* | −0.08 | 0.13 | 0.00 | 0.28** | 0.22* | – | – | – |
| 17. Expenses | −0.08 | −0.09 | 0.10 | 0.76** | 0.07 | −0.08 | −0.07 | 0.08 | −0.09 | −0.10 | 0.10 | 0.25* | −0.07 | 0.18 | 0.06 | 0.14 | 0.52** | – |
| 18. Funding | −0.13 | 0.09 | −0.03 | 0.72** | 0.05 | −0.04 | −0.06 | 0.15 | −0.04 | −0.25* | 0.10 | 0.15 | −0.12 | 0.16 | −0.04 | 0.06 | 0.15 | 0.76** |
| Mean | 37.62 | 0.58 | 4.87 | 1.75 | 914.81 | 0.08 | 0.2 | 0.31 | 0.1 | 3.93 | 3.72 | 3.76 | 3.72 | 3.66 | 3.75 | 3.45 | 18,191.7 | 114,129.1 |
| SD | 10.79 | 0.5 | 4.69 | 3.81 | 524.74 | 0.27 | 0.41 | 0.47 | 0.3 | 0.48 | 0.59 | 0.73 | 0.56 | 0.47 | 2.28 | 0.96 | 62,995 | 846,409.3 |

*Note*. Cronbach's α internal consistency estimates are placed on the diagonal in parentheses; $n = 93$. *$p < .05$; **$p < .001$. Variables 1–14 collected at *t1*, 15-18 at *t2*. Data in this table on progress, expenses, and funding refers to the past 2 months (*not* the whole period of observation).

**Table 7**
Within-person t-tests comparing SJT and self-report effectuation scores in Study 4.

| | Mean SJT | Mean self-report | *t* | Two-sided *p* |
|---|---|---|---|---|
| Effectuation (overall) | 3.74 | 3.41 | 8.23 | <0.001 |
| Affordable loss | 3.75 | 4.18 | −7.87 | <0.001 |
| Leverage contingencies | 3.83 | Experimentation: 2.80 | 14.81 | <0.001 |
| | | Flexibility: 3.96 | −1.72 | 0.09 |
| Co-creation / pre-commitments | 3.70 | 2.70 | 12.40 | <0.001 |
| Focus on means | 3.68 | Not assessed by self-report | – | – |

*Note.* n = 176; SJT and self-report scores at *t1*.

**Table 8**
Regression results for models predicting venture outcomes from SJT scores in Study 4.

| | Venture progress (t2) | Venture expenses (t2) | Venture funding (t2) |
|---|---|---|---|
| *Controls included* | | | |
| Causation (SJT) (t1) | 0.21[↓] (0.23) | −0.14[↓] (10,152.79) | **−0.32** (136,989.69)** |
| Aff loss (SJT) (t1) | −0.07 (0.18) | −0.02 (8109.87) | −0.01 (108,733.82) |
| Contingencies (SJT) (t1) | −0.11 (0.16) | **0.21* (7028.31)** | **0.25* (94,790.26)** |
| Focus on means (SJT) (t1) | −0.01 (0.19) | −0.03 (8304.98) | −0.04 (112,081.43) |
| Co-creation (SJT) (t1) | **0.23* (0.22)** | 0.03 (9756.55) | 0.06 (131.094.87) |
| **$R^2$** | 0.26 | 0.67 | 0.67 |
| **Adjusted $R^2$** | 0.12 | 0.60 | 0.60 |
| ***F (p)*** | 1.81 (0.05) | 10.05 (< 0.001) | 9.95 (< 0.001) |

*Note.* Standardized regression coefficients are shown; standard errors in parentheses. The coefficients for the control variables were left out of the tables for brevity. They are available by request from the first author. The $R^2$ for the models including only the control variables as predictors was 0.13 for venture progress, 0.62 for business expenses, and 0.56 for business funding. N = 93.
[↓] significant at $p < .10$; *significant at $p < .05$; ** significant at $p < .001$.

distinct from causation, providing evidence of discriminant validity.

The CFA[12] results can be found in Table 4. Reviewing CFI, TLI, IFI, and RMSEA statistics (Byrne, 2001) reveals that both the single and two-factor models fit the data poorly, while the five-factor model provided a good fit for the data (CFI = 0.95, TLI = 0.95, IFI = 0.96, RMSEA = 0.03). In sum, the five-factor model provided the best fit to the data, indicating that the five scales assessing effectual principles and causation are distinct and independent from each other. Finally, we also tested a second-order model to determine whether the shared variance between effectual principles can be explained through the presence of a higher-order effectuation construct. This second-order model fit the data well ($\chi^2 = 797.88$; CFI = 0.94, TLI = 0.94, IFI = 0.95; RMSEA = 0.03). Our data thus seems to support the retention of an effectuation higher-order construct underpinning the four effectual principles (Focus on Means, Affordable Loss, Co-Creation, Leverage Contingencies) assessed by our SJT.

*3.6.3.2. Convergent and discriminant validity.* Tables 5 and 6 show the means, standard deviations, and intercorrelations of the study variables. First, we examine the convergent and discriminant validity of the SJT with the self-report measure of effectuation and causation (Chandler et al., 2011). Inspection of the correlation matrix (Table 5) indicates evidence of both convergent and discriminant validity for all the SJT scales with the self-report effectuation measure (excluding focus on means, given the self-report measure does not assess it). The correlations between matched principles/logics on the two measures range between 0.22 and 0.37 and are larger in size than the correlations with non-matched principles.

*3.6.3.3. Comparison of SJT and self-report scores of effectuation.* We argued that self-report measures (e.g., Chandler et al., 2011) should underestimate entrepreneurs' use of effectuation compared to SJTs, for several theoretical reasons (see section 2.2). We also tested this assumption empirically in our data, by carrying out within-person *t*-tests comparing scores on matched effectual principles, as well as an overall effectuation score, between the self-report and SJT measures. We report the results in Table 7.

The results show that SJT scores are significantly higher for SJT measures of overall effectuation, leverage contingencies against the self-report experimentation measure, and co-creation (all at $p < .001$). There are no significant differences between SJT leverage contingencies and the self-report flexibility measure ($p = .09$). However, we find that self-report scores for affordable loss are significantly higher than the SJT measure. Overall, our results support our theoretical arguments that self-report measures of effectuation underestimate entrepreneurs' use of effectuation compared to SJTs, however we discuss and interpret the results in more depth

[12] In line with recommendations by Edwards (2001), we used several fit indices to evaluate the different models tested. We used the comparative fit index (CFI), incremental fit index (IFI), and the Tucker-Lewis Index (TLI) as indicators that are more stable for smaller sample sizes (Fan et al., 1999). Values greater than 0.90 are considered to represent acceptable model fit, whereas values above 0.95 indicate good fit (Bentler, 1992). We also examined the root mean square error of approximation (RMSEA), with values below 0.05 representing a good fit (Byrne, 2001).

in section 4.1.2.

*3.6.3.4. Predictive and incremental validity.* The predictive validity results for the SJT are presented in Table 8. In the table, we present results for the full models, accounting for shared variance between our constructs; we also test each logic/principle independently and report significant results in text. Predicting *venture progress*, co-creation at t1 had a significant positive effect on venture progress at t2 ($\beta = 0.23$, $p = .04$). When testing logics separately, we replicate the positive effect of co-creation at t1 ($\beta = 0.26$, $p = .01$) and we also find a positive effect of causation at t1 on venture progress at t2 ($\beta = 0.21$, $p = .047$). Predicting *venture expenses* at t2, causation at t1 had a marginally significant, negative effect ($\beta = -0.14$, $p = .07$), while leverage contingencies at t1 had a significant, positive effect ($\beta = 0.21$, $p = .01$). When testing logics separately, we replicate the positive effect of leverage contingencies at t1 on venture expenses at t2 ($\beta = 0.18$, $p = .02$). Predicting *venture funding*, there was a significant negative effect of causation at t1 ($\beta = -0.32$, $p < .001$) and a significant positive effect of leverage contingencies at t1 ($\beta = 0.25$, $p = .003$). As robustness checks, we re-ran our models excluding demographic variables (Spector and Brannick, 2011), and excluding all control variables; we replicate all effects. Furthermore, we also tested the models for venture expenses and funding using an aggregate variable assessing expenses and funding over the 14 months (in a sub-sample of 60 entrepreneurs where we had complete data available), and we replicate our Table 8 main effects.

Finally, we analyzed the incremental validity of our SJT over Chandler et al.'s (2011) self-report scale for the venture outcomes. To do this, we ran a stepwise regression where we added the control variables in step 1, added the self-reported scale for causation and each effectual principle in step 2, and added the SJT for the matched construct in step 3. The full results are available from the authors on request. In line with our expectations, we find evidence for the incremental validity of our SJT measure beyond the self-report measure, and no evidence for the incremental validity of the self-report measure over the SJT measure. Specifically, for predicting *venture progress* at t2, SJT co-creation at t1 predicted incremental variance above self-reported co-creation at t1 ($\Delta R^2 = 0.07$, $p = .01$); while self-reported co-creation at t1 did not predict incremental variance in venture progress at t2. For predicting *venture expenses* at t2, SJT leverage contingencies at t1 predicted incremental variance above self-reported flexibility ($\Delta R^2 = 0.02$, $p = .03$), experimentation ($\Delta R^2 = 0.02$, $p = .03$), and both experimentation and flexibility tested in the same model ($\Delta R^2 = 0.02$, $p = .03$); whereas self-reported flexibility and experimentation at t1 did not predict incremental variance in venture expenses at t2. For predicting *venture funding* at t2, SJT causation at t1 predicted incremental variance above self-reported causation at t1 ($\Delta R^2 = 0.04$, $p = .005$); while self-reported causation at t1 did not predict incremental variance, in venture funding at t2. Appendix Table 3 presents further results on the predictive validity of the Chandler et al.'s (2011) self-reported scale in Study 4. Only self-reported *causal* behaviors at t1 related to venture progress at t2 ($\beta = 0.28$, $p = .045$). The self-reported effectuation scales were *not* related to venture outcomes.

## 4. Discussion

Over the course of three pilot studies and four main studies this paper develops and validates a new SJT that captures entrepreneurs' use of effectuation as heuristics in specific situations. We examined the content validity of the newly developed measure, explored and confirmed its dimensionality, and provided evidence of convergent, discriminant, incremental, and predictive criterion-related validity in a study spanning 14 months. Our work makes three contributions: firstly, we make a methodological contribution to effectuation research by introducing a robust, valid SJT measure of effectuation with significant strengths; secondly, we make a theoretical contribution to effectuation by providing conceptual clarity on effectual principles as heuristics and elucidating their relationship to venture outcomes; thirdly, we introduce SJTs as an assessment method to entrepreneurship research and identify research streams in entrepreneurship which could benefit from the adoption of the SJT methodology.

### *4.1. Methodological and theoretical contributions of our SJT to the effectuation literature*

#### *4.1.1. Measuring effectuation as heuristics*

Building on recent theorizing and research that conceptualizes effectual principles as heuristics (Koller et al., 2022; Zhang et al., 2021; Zhang and Cueto, 2017) our study contributes a new SJT measure of effectuation that is aligned with extant work in cognitive sciences (Gigerenzer and Gaissmaier, 2011; Todd et al., 2012). It integrates these works with extant methodological work on SJTs in applied psychology that shows SJTs have unique strengths in predicting performance outcomes (Kepes et al., 2024; Weekley et al., 2015). As a result, our SJT directly captures entrepreneurs' use of effectuation as heuristic decision-making by assessing how they respond to specific situations. This contrasts with and complements current self-report measures of effectuation which assess effectuation by asking entrepreneurs to report on their behaviors across an extended period in the past, thus requiring entrepreneurs to first recall and then mentally aggregate past actions across diverse situations in new venture creation (McKelvie et al., 2020). Because self-reports rely on recall and aggregate across (as opposed to distinguish) specific situations, they are *not* designed to measure implicit decision-making in a given situation, which is the essence of heuristic decision-making (Gigerenzer and Gaissmaier, 2011). This is why self-report measures are rarely (if ever) used in cognitive sciences to measure heuristics (Todd et al., 2012).

Thus, our SJT of effectuation offers a novel measurement of effectuation to entrepreneurship research that is more directly aligned with effectual principles as heuristics. In doing so, our SJT importantly re-connects the measurement of effectuation with its theoretical roots in the cognitive sciences (Read and Sarasvathy, 2005; Sarasvathy, 2008). Robust theory-aligned measurement is essential for any research area as it underpins and shapes the insights that can be derived from empirical studies. Our new SJT of effectuation will help shape our understanding of how and why entrepreneurs' use of effectuation as heuristics matters, when effectuation is used, and with what consequences (see 4.2).

#### 4.1.2. Clarifying the theoretical properties of effectual principles

Beyond this methodological contribution, our empirical findings help refine the properties of the effectuation construct and its principles (MacKenzie et al., 2011; Podsakoff et al., 2016) thereby offering a theoretical contribution to effectuation research. We show that causation is a unidimensional construct, whereas the four effectuation principles are empirically distinct constructs. These findings align with Chandler et al.'s (2011) empirical findings (though their work omits the focus on means principles), but it departs from Sarasvathy's (2001a) theoretical conceptualization of effectuation and causation as *both* consisting of four contrasting principles. Notably, our findings are consistent with the theoretical notion of causation as a deliberative, general-purpose logic that can be used across situations and with effectual principles as *heuristics* that entrepreneurs use to achieve fit with *specific* situations (Gigerenzer and Brighton, 2009). This is conceptually consistent with cognitive science research on heuristics and recent work on effectuation as a heuristic (Koller et al., 2022; Zhang et al., 2021; Zhang and Cueto, 2017), which suggest that we should not expect to see one overall effectuation factor but instead that effectual principles—as heuristics—can move independently of each other. They are deployed as and when decision-making situations 'call' for them. The focus on means principle helps entrepreneurs make decisions, specifically, about the evaluation and use of resources; the affordable loss principle applies specifically to resource investment decisions; the leverage contingencies principle specifically helps entrepreneurs make decisions when unexpected events happen; and the co-creation principle specifically helps entrepreneurs navigate relationships with potential stakeholders (Martina, 2020; Sarasvathy and Dew, 2005). By contrast, causation may apply to a wider variety of situations that entrepreneurs encounter in the process of new venture creation.

Our empirical results comparing SJT and self-reported scores on effectual principles also provide new clarification on conceptual differences between individual effectual principles. This enriches past research that has tended to treat effectual principles interchangeably as part of the overall effectuation construct (Shirokova et al., 2020; Smolka et al., 2018). As theorized, we find that entrepreneurs report higher use of co-creation and leverage contingencies principles in the SJT compared to self-report, providing support for our theoretical arguments that entrepreneurs use these principles in an implicit and situation-specific manner. We found no significant differences between self-reported flexibility and SJT-based leverage contingencies. Entrepreneurs' self-reported use of the flexibility principle may in fact be dependent on the situations and decisions that they encounter, and hence may capture more implicit, intuitive processes, similar to the SJT assessment of leverage contingencies. Conversely, affordable loss was the only effectuation principle for which self-reports yielded higher scores than the SJT. This may be because the affordable loss principle employs some deliberate reasoning, as it requires entrepreneurs first to establish their own levels of affordable loss and compare their potential investments to this threshold (Dew et al., 2009b; Martina, 2020). Once levels of acceptable affordable loss have been determined, affordable loss is likely to work as a heuristic. In sum, to develop the theoretical lens of effectuation as heuristics that our SJT assesses, we encourage future research to clarify the heuristic nature of each effectual principle including their building blocks (e.g., rules for information search and decision-making) and the cognitive capacities they engage (e.g., memory, tacit knowledge) (Gigerenzer et al., 1999; Gigerenzer and Gaissmaier, 2011).

#### 4.1.3. Effectual principles and venture performance

Importantly, our SJT provides a new robust tool for advancing our understanding of the relationship between effectuation and venture performance (Brettel et al., 2012; Deligianni et al., 2017; Laskovaia et al., 2017; Smolka et al., 2018). This, firstly, contributes methodological insight to effectuation research by introducing a new measurement tool with evidence of predictive validity for venture outcomes, and grounded in the strong evidence on the criterion-related validity of SJTs in the applied psychology literature (Christian et al., 2010; McDaniel et al., 2001). Secondly, linking effectuation and venture performance also contributes new theoretical insight. It emphasizes the importance of studying the predictive validity of effectual *principles* in *specific* situations aligned with seminal cognitive science research on heuristics and their performance (Gigerenzer and Brighton, 2009; Luan et al., 2019).

More specifically and in line with our theoretical arguments, we show that the construct of effectuation assessed by our SJT has predictive validity (in a *prospective panel* study) for three theoretically relevant venture outcomes (venture progress, venture expenses, and venture funding). This offers new insight to effectuation research which has struggled to link effectuation with venture performance (Grégoire and Cherchem, 2020). The predictive validity of our SJT also showcases that despite the SJT asking entrepreneurs to make decisions in a context that may be rather different to that of their own venture, effectual principles captured by the SJT are predictive of venture outcomes over a relatively long period of time (14 months). Hence, our SJT captures important signals about entrepreneurs' future venture performance. Importantly, we also show that our SJT measure has incremental validity over self-reported measures of effectuation and causation in predicting venture outcomes, whereas the self-reported scales do not predict any unique variance above the SJT in the venture outcomes we tested. Of course, these results should be interpreted with caution as they are based on only one study. We encourage future research to further test and compare the performance of SJT and self-reported measures of effectuation in the prediction of venture outcomes.

Specifically, our findings contribute new theoretical insights by highlighting a more nuanced relationship between effectual principles and specific venture outcomes than existing research, which relates overall effectuation (*not* its principles) to venture outcomes (Brettel et al., 2012; Deligianni et al., 2017; Laskovaia et al., 2017; Smolka et al., 2018). Viewing effectual principles as heuristics helps us understand *why* effectual principles may relate to some venture outcomes, but not others – because effectual principles align with achieving *certain* outcomes in *specific* situations (Koller et al., 2022). For instance, co-creation impacted venture *progress* but not funding. This highlights how co-creating with self-selected stakeholders can enable entrepreneurs to make progress with their venture goals (Uy et al., 2015), while not affecting more distal venture performance outcomes, such as amount of funding received. This result resonates with findings on the divergent effects of social capital on new venture performance (Batjargal, 2007; Batjargal, 2003). Another example is the positive impact of the leverage contingencies principle on venture *expenses*, which illustrates

how leveraging unforeseen events may result in higher costs for the venture. Importantly, this distinct pattern with which specific effectual principles impact venture outcomes suggests that future research should move away from relating overall effectuation to venture outcomes and instead investigate specific relationships between individual effectual principles and theoretically matched venture outcomes (e.g., leverage contingencies and its relationship with resource use). Our SJT enables such research.

Viewing effectual principles as heuristics also enables us to better understand when (i.e. in which *specific situations*) effectual principles relate to higher venture performance outcomes (Gigerenzer and Gaissmaier, 2011; Mousavi and Gigerenzer, 2017; Todd et al., 2012). For instance, our results show that entrepreneurs' causal logic has a negative effect on the amount of *funding* the venture receives, whereas the leverage contingencies principle has a positive effect on funding. This is surprising, because most of the literature on venture funding has focused on the beneficial role of business planning (an approach closely related to causation) on funding outcomes (Kirsch et al., 2009; Latifi et al., 2024). It is possible that our findings are influenced by situational characteristics (i.e. COVID-19). During this period, flexibility and adaptability (i.e. leverage contingencies) were important mechanisms underpinning entrepreneurs' resilience (Stephan et al., 2023).[13] Entrepreneurs who leverage contingencies may be more likely to secure investment as they show more receptivity to environmental changes and investor suggestions, which investors value (Warnick et al., 2018). It could also be that these entrepreneurs more successfully secure funding from more diverse sources as they are more opportunistic in their approach to investment. Again, the heuristics view of effectuation and our SJT enable new research that considers specific effectual principles conferring performance benefits in *certain* situations. Conceptually, it requires researchers to theorize the *fit* between situational characteristics (e.g., uncertainty, complexity) and effectual principles to predict performance (Gigerenzer and Gaissmaier, 2011; Koller et al., 2022).

### 4.2. New directions for effectuation research using SJT measurement

Our SJT can offer new directions for effectuation research in four ways. *Firstly*, our SJT can help advance a cognitive science perspective on effectuation (Koller et al., 2022; Shepherd et al., 2015) because unlike existing measures it directly assesses effectuation as heuristics in entrepreneurial decision-making. Existing self-report measures of effectuation assess aggregate past behaviors, and therefore there has been limited (quantitative) research investigating effectuation through a cognitive lens. Using our SJT, future research can explore how effectuation and its principles relate to other common heuristics studied in the cognitive sciences. For instance, focus on means may relate to the recognition heuristic which describes automatic choices for familiar or easy to recognize options (Goldstein and Gigerenzer, 2002), and co-creation may relate to the tit-for-tat heuristic studied in negotiation settings (Axelrod, 1984). Furthermore, our SJT can also be used to investigate the relationship between effectuation and biases in entrepreneurs' decision-making (Zhang et al., 2021; Zhang and Cueto, 2017). For instance, entrepreneurs' use of affordable loss may relate to reductions in decision-making biases such as the sunk cost fallacy (Arkes and Blumer, 1985), the optimism bias (Weinstein, 1980), and loss aversion (Kahneman and Tversky, 1979). Such research can uniquely advance our understanding of the micro-foundations of entrepreneurs' effectual decision-making and entrepreneurial cognition (Shepherd, 2015), and can support entrepreneurs in making better decisions and avoiding biases.

Our SJT can also help advance effectuation research by generating new predictions underpinned by robust research in cognitive science by offering an empirically validated measure of causation as a general-purpose logic and specialized effectual principles as heuristics (see also Koller et al., 2022). Importantly, existing research on effectuation has mostly focused on describing entrepreneurs' use of effectuation (when and why do they use effectuation for certain decisions; Grégoire and Cherchem, 2020; Koller et al., 2022; Reymen et al., 2015). Research employing self-report measures has struggled to link effectuation to venture performance (McKelvie et al., 2020). Thus, there is much potential for better understanding the performance outcomes related to entrepreneurs' use of effectuation and causation in specific situations or decisions (assessed by SJT) by leveraging work on ecological rationality (Gigerenzer and Gaissmaier, 2011; Koller et al., 2022; Todd et al., 2012). There is increasing evidence in the cognitive sciences suggesting that heuristics can outperform optimizing in many situations, particularly under high uncertainty (Gigerenzer, 2008; Gigerenzer and Gaissmaier, 2011; Luan et al., 2019). Effectuation research can leverage such findings to better understand the specific situations in which effectuation may be beneficial to venture performance (Arend et al., 2015; Frese and Gielnik, 2023).

*Secondly*, our SJT assesses distinct effectual principles (rather than overall effectuation) and thereby can advance our understanding of those principles of effectuation that have received less attention in past quantitative research, such as focus on means.[14] For instance, little is known about the role of individual-level resources for focus on means beyond entrepreneurial expertise (Dew et al., 2009a; Sarasvathy, 2001b). Future research could consider how entrepreneurs mobilize other human and social capital and through what mechanisms. Entrepreneurial passion, entrepreneurial self-efficacy, and risk perceptions may also shape entrepreneurs' use of effectuation (Stroe et al., 2018), and they likely impact the four effectual principles in distinct ways (Frese et al., 2019).

[13] Our exploratory analyses of interactions between effectuation/causation and COVID-19 impact on the entrepreneur' businesses seem to support this explanation. Causation diminished venture funding when the impact of COVID-19 was perceived as positive, implying that entrepreneurs may have stuck to their original plans and were not responsive to new opportunities arising out of this crisis. This interpretation is also consistent with the positive effect of leverage contingencies on venture funding when perceived impact of COVID-19 was positive; full results of these analyses are available by request from the first author.

[14] Chandler et al.'s (2011) measure does *not* assess the focus on means principle despite being one of the most commonly used measures in research investigating the relationship between effectuation and venture performance (Deligianni et al., 2017; Laskovaia et al., 2017; Shirokova et al., 2020; Smolka et al., 2018).

In our predictive validity analysis for the SJT, we did not find any significant effects of entrepreneurs' focus on means and affordable loss principles on venture outcomes. There are several possibilities for these non-findings which we urge future research to investigate. It could be that the effects of these two principles are *contingent* on certain venture characteristics, such as industry and stage of development, as well as characteristics of the entrepreneur, such as previous experience, social and financial capital. Entrepreneurs in capital-intensive industries such as biotech may not benefit from adopting an affordable loss principle in their decision-making. Similarly, it could be that entrepreneurs who lack industry experience or those with low social capital may not benefit from adopting a focus on means principle in their decision-making due to given means being insufficient, or hindering their venture progress and their efforts to secure funding. Future research could investigate whether the effects of focus on means and affordable loss on performance differ between different entrepreneurs, and in different venture contexts.

It may appear surprising that affordable loss did not significantly predict entrepreneurs' use of resources (i.e. venture expenses) – however, the definition of affordable loss emphasizes resource investments that are affordable to the decision-maker (Dew et al., 2009b; Martina, 2020). Thus, it may be that affordable loss is linked to more subjective measures of resource use, or measures of resource efficiency (Delmas and Pekovic, 2015), rather than actual expenses (an objective outcome). While there has been some conceptual work developing the construct of affordable loss (Dew et al., 2009b; Martina, 2020), empirical work investigating the nomological net and outcomes of affordable loss is scarce. We urge future researchers to explore the relationship between affordable loss and related constructs such as entrepreneurial resourcefulness (Williams et al., 2024), bootstrapping (Winborg and Landstrom, 2001), bricolage (Baker and Nelson, 2005), or frugality (Michaelis et al., 2020). This would help to ground effectuation theory better in broader entrepreneurship theory and establish its relevance and distinctiveness (Arend et al., 2015; Frese and Gielnik, 2023; Read et al., 2016).

Similarly, the focus on means principle might drive more micro-level processes and outcomes throughout new venture development, rather than distal venture outcomes such as funding. For instance, the focus on means principle might enable entrepreneurs to test their ideas more quickly (Camuffo et al., 2020) by using existing resources rather than acquiring additional ones for implementation. Might entrepreneurs using this principle achieve a first sale more quickly by leveraging existing networks? Moreover, does trying to create new products or services using re-combinations of existing means result perhaps in particularly creative or innovative new venture ideas (Sarasvathy, 2024; Sarasvathy, 2021)?

*Thirdly*, our SJT opens new avenues for effectuation research in terms of enabling experimental research (for which current self-report measures are *not* suitable) to test causal claims on the antecedents of effectuation. Specifically, the SJT could be easily adapted for use in experiments (Grégoire et al., 2019) to test specific hypotheses related to the situational and/or decision attributes that drive entrepreneurs' use of effectuation. Existing research has suggested that uncertainty (Jiang and Tornikoski, 2019; Reymen et al., 2015) and decision structure (Koller et al., 2022) may be two such attributes. Our SJT could facilitate future research that systematically tests competing explanations (e.g., different levels or different types of uncertainty) driving entrepreneurs' use of effectuation. For instance, the decision scenarios in our SJT could be adapted to manipulate decision structure (for an example: Koller et al. (2022) who manipulated decision complexity and costs) and how this affects entrepreneurs' use of effectuation and causation.

*Lastly*, future research investigating whether effectuation can be taught (Zhu et al., 2021) could leverage our SJT measure. Effectuation is conceptualized as a form of entrepreneurial expertise (Sarasvathy, 2008), but our understanding of whether effectuation is teachable (to novice entrepreneurs), as well as how entrepreneurial expertise develops, is limited. Research could leverage our SJT to advance our understanding of this topic. Such research can draw on initial promising evidence that interventions can change entrepreneurs' decision-making (Camuffo et al., 2024; Camuffo et al., 2020; Novelli and Spina, 2024). However, such research is currently limited by the lack of standardized assessments that can assess changes in individuals' decision-making. Our SJT, as a direct measure of entrepreneurs' decision-making logics, can validly assess changes between pre- and post-intervention effectuation. It is also more suitable for assessing such changes than self-report measures. Our SJT isolates individuals' predisposition to use certain effectual principles in specific situations, whereas self-report measures assess actual usage of effectuation as part of past venture development (Berends et al., 2014; Jiang and Tornikoski, 2019; Reymen et al., 2015).

### 4.3. Advice on how to use the SJT in future effectuation research and how to mitigate its limitations

So far, we outlined the intended benefits of using an SJT assessing effectuation as heuristics and new areas of research. However, we do *not* argue that our SJT should replace existing self-report measures of effectuation in *all* future research. As our analysis of discriminant validity shows, the SJT and self-report measures of effectuation assess different constructs (situation-specific use of effectuation versus generalized behavioral tendencies, see Study 4). Thus, our SJT can be used alongside self-report behavioral scales or observational measures of effectuation (see McKelvie et al., 2020). Based on our findings, we suggest that our SJT measure should be the preferred measure of effectuation in four circumstances: (a) to predict *venture performance*; (b) for 'situated' research questions that concern entrepreneurs' decision-making in a *given situation*, not their general behavioral usage of effectuation and causation in their ventures; (c) to assess the *principles* underpinning effectuation, in particular focus on means (which is not covered by all self-report measures); (d) to assess *cognitive decision-making* as opposed to observable behaviors.

Measurement validation is an ongoing and iterative process. We hope future research can further validate the SJT using other data

sources, such as observational data regarding entrepreneurs' behaviors (McKelvie et al., 2020) or archival data regarding venture performance. To encourage the use of our SJT alongside other measures, we encourage future research to validate a short version of our SJT.[15]

We also urge researchers to reflect on the type of entrepreneur they are studying and the suitability of the venture scenario presented in our SJT for their sample. Our SJT describes the overall scenario of an entrepreneur working in a high-tech context. Other scenarios might be more relatable to social or necessity entrepreneurs, or entrepreneurs focusing on the provision of services. If necessary, the scenario presented in our SJT can be adapted to the specific characteristics (e.g., industry, necessity entrepreneurship) of the sample used. Nevertheless, our SJT is still suitable for diverse samples of entrepreneurs. For instance, for student or novice entrepreneurs it provides a rich venture scenario that can help them immerse themselves in a situation they may have had limited experience with. For high-growth entrepreneurs, it can focus them on developing products as part of their venture by providing a relatable scenario that mirrors their everyday work. For experienced serial entrepreneurs who founded several businesses with various types of business models, the SJT provides a fixed venture scenario to anchor and enable comparisons of their preferences for effectuation.

We developed and validated our new SJT of effectuation in English, with multiple samples of entrepreneurs from the United Kingdom. Based on the SJT literature, our SJT can be used in other contexts, including with culturally diverse samples of respondents given the cultural neutrality of the scenario and situations presented. However, we would advise researchers to conduct an initial validation study in their specific context. We hope future research can employ the measure and show its generalizability across different cultural contexts.

### 4.4. SJTs for entrepreneurship research

Despite the increased usage and prevalence of SJTs in applied psychology (Kepes et al., 2024; Weekley et al., 2015) and in practice (UK Government, 2024), SJTs are not used in entrepreneurship research (two notable exceptions are Baum et al. (2011) and König et al. (2010), König et al. (2007). We propose that SJTs are a useful new tool for entrepreneurship research more broadly (outside of effectuation), because SJTs, first, help address some of the limitations of self-report measures in assessing implicit cognitive processes and situational dynamics in entrepreneurial decision-making. Second, SJTs can facilitate new types of entrepreneurship research.

#### 4.4.1. New research into non-rational entrepreneurial logics and the destructive side of entrepreneurship

There have been recent calls for diversifying the types of cognitive logics studied in the entrepreneurship literature to include non-rational and intuition-based decision-making (Lerner et al., 2018; Pollack et al., 2023; van Lent et al., 2024). However, there has been less consideration of how these non-rational entrepreneurial logics should be assessed empirically. Studies started using self-report questionnaires to assess *proxies* of non-rational behavior (e.g., Hunt et al., 2022 use psychiatric questionnaires to proxy impulsive behavior) or use agent-based simulation methods (Bort et al., 2024). We propose the SJT is a method that can more directly assess non-rational logics, because SJTs simulate specific situations to elicit a range of entrepreneurial logics (from rational to non-rational; Brooks and Highhouse (2005)). This is important considering that non-rational and impulsive actions are underpinned by spontaneous and implicit cognitive processes (Hunt et al., 2022; Lerner et al., 2018), which makes them difficult to assess with self-report measures relying on conscious recall and introspection.

One exemplary domain of decision-making where SJTs could be deployed is that of (un)ethical decision-making. There are growing calls to consider the destructive side of entrepreneurship, i.e. the potential negative impacts on others that can result from entrepreneurial pursuits (Shepherd, 2019). This poses a challenge of how to measure destructive actions. Self-report measures relying on entrepreneurs' conscious recall and interpretation of their cognitions and actions work well for capturing the positive, socially desirable side of entrepreneurship. However, they are likely to work less well to capture the destructive side and the cognitions underpinning and driving actions with negative impacts on others, for several reasons: first, self-reports of unethical cognitions and actions suffer from self-presentation biases (Fernandes and Randall, 1992). This means that in responding to a self-report, entrepreneurs actively suppress or alter their recall of information to justify these behaviors to themselves or to other stakeholders (Moore and Gino, 2015). Second, social desirability additionally lowers individuals' motivation to accurately self-report that they engaged in unethical and destructive behaviors (Randall and Fernandes, 1991). Finally, at least some unethical and destructive behavior results from automatic rather than deliberate decisions (Lerner et al., 2018), making it difficult to consciously recall.

Given SJTs are more implicit, direct measures of cognition compared to self-reports, they may be a suitable methodology for capturing some of the cognitions and behaviors associated with destructive entrepreneurship. For instance, SJTs have been used in the

[15] The average SJT completion time in our studies was around 5 min. It is much faster to complete than other available measures that directly tap into concurrent decision-making such as the think-aloud protocols used by (Sarasvathy, 2008) to study effectuation. As she notes: “Subjects did use an hour and a half on average for completing the decision-making experiment [10 decision problems]” (p. 23).

research integrity literature to assess unethical decision-making among researchers (Kligyte et al., 2013; Mumford et al., 2006). However, whereas unethical decision-making has started being explored in the entrepreneurial domain (Shepherd et al., 2013), there are few attempts at operationalizing and assessing this type of decision-making in quantitative work, likely precisely because of the difficulty of measuring it accurately.[16] SJTs could be used to assess the range of logics (from rational to non-rational) (van Lent et al., 2024) entrepreneurs leverage during (un)ethical decision-making. This would advance our understanding of how prevalent non-rational logics are among entrepreneurs, the individual-level factors that drive reliance on non-rational logics, as well as the outcomes associated with engaging non-rational logics.

#### *4.4.2. New research into entrepreneurial heuristics and situated cognition*

The nature of work in entrepreneurship entails entrepreneurs having to make quick decisions, whilst being presented with a high volume of information, under high uncertainty, with little expertise in how to make decisions in many different areas of the new venture. The cognitive sciences literature demonstrates that individuals rely on heuristics to make decisions in precisely such conditions (Gigerenzer and Gaissmaier, 2011; Luan et al., 2019). Indeed, entrepreneurs are more likely to use heuristics compared to managers (Busenitz and Barney, 1997), who arguably face less uncertainty and have more support in decision-making. A research stream on situated cognition in entrepreneurship now emphasizes the importance of specific conditions and situations in which entrepreneurial decision-making takes place (Dew et al., 2015; Mitchell et al., 2021; Mitchell et al., 2011). Similarly, recent entrepreneurship work demonstrates the importance of decision-fit, i.e., how heuristics fit specific situations that decision-makers encounter (Koller et al., 2022). Thus, entrepreneurs' cognition rests on their ability to adapt their logics to achieve desirable outcomes in dynamic environments (Bastian et al., 2025).

We argue that beyond the SJT of effectuation that we present in this paper, there is untapped potential to further use SJTs for operationalizing and researching *situated* entrepreneurial cognition constructs in general (Mitchell et al., 2011). SJTs, through their ability to sample cognition and decision-making in specific situations, can enable researchers to examine situated entrepreneurial cognition constructs in more depth. Critically, SJTs can capture different logics of situated cognition, from the more rational (e.g., adaptive cognition, metaheuristics, cultural adaptation; Bastian et al., 2025) to the less rational (e.g., heuristics, Zhang and Cueto, 2017; appropriateness logics, Lerner et al., 2018). For instance, SJTs could be used in future entrepreneurship research to capture how entrepreneurs adapt their cognitive logics in response to dynamic or changing situations: What logics do entrepreneurs use in situations where a co-founder, key investor or customer may unexpectedly leave the venture? How do entrepreneurs use heuristics to quickly scan and efficiently select potential opportunities to pursue in complex and fast-changing environments? (How) Do they shift to more rational logics when it comes to making decisions about how to allocate resources to exploit these? Do they use rational logics to develop pitches but then switch to heuristics for more open-ended 'asks' (Sarasvathy, 2021) or to adapt their pitches to customers or stakeholders of different cultural backgrounds?

Another aspect of situated cognition that SJTs are well positioned to assess is the role of affect in cognition, in particular the role of state (or event-generated) affect (Baron, 2008; Portocarrero et al., 2025). State affect arises in relation to external events or situations, which means that self-report methods may be unable to capture how the situation-specific nature of affect shapes entrepreneurs' cognition. SJTs could help researchers more accurately capture and simulate event-generated affective influences on entrepreneurial decision-making. For instance, entrepreneurial fear of failure has been defined as socially situated cognition (Cacciotti et al., 2016). However, current methods for assessing this construct rely on self-report recollections of past experiences over diverse situations in new venture creation (Cacciotti et al., 2020). An SJT of entrepreneurial fear of failure could capture entrepreneurs' situated affect and cognitions in response to specific situational triggers, such as pitches, or customer or team interactions.

Lastly, past research on opportunity exploitation has emphasized that it results from an interaction between the environment (e.g., social capital) and heuristics (De Carolis and Saparito, 2006). However, much of the research investigating cognitions in relation to entrepreneurial opportunities has focused on deliberate opportunity evaluation or assessment (Davidsson et al., 2021), or on intentions to exploit (Dimov, 2007). By contrast, not much research has explored *how* entrepreneurs exploit specific opportunities. SJTs could be developed to assess entrepreneurs' reliance on certain logics for opportunity exploitation, thus more directly capturing the interaction between specific opportunities (i.e. situations) and cognitive logics.

## 5. Conclusion

We develop and validate a new SJT of effectuation that helps overcome some of the main limitations of existing self-report scales relying on entrepreneurs to recall and mentally aggregate their use of effectuation across many past situations. Methodologically, we find the newly developed SJT has robust construct, incremental, and predictive validity for venture outcomes, thus offering a promising new measure of effectuation as heuristics that complements current self-report measures. Theoretically, we clarify the properties of effectual principles as heuristics and their consequences for venture performance outcomes. Our SJT facilitates new types

[16] SJTs assessing entrepreneurs' (un)ethical decision-making could depict ethical dilemmas, such as that presented by Lerner et al. (2018) whereby Don Mullins, an asbestos abatement supervisor from the US, is faced with an unexpected entrepreneurial opportunity when a potential customer approaches him with a proposal to perform an unplanned (and illegal) asbestos removal job, without involving his employer. This illustrates a dilemma whereby the entrepreneur could either use a more rational, deliberative cognitive logic of considering the potential risks and benefits of performing an 'unpermitted' job versus taking non-rational, impulsive action and just going ahead with the job without considering the potential consequences of this decision.

of research on effectuation, such as furthering our theoretical understanding of effectuation as heuristics through a cognitive sciences lens. More broadly, we introduce SJTs as a promising methodology for research on the non-rational and the destructive side of entrepreneurship as well as on situated cognition.

## CRediT authorship contribution statement

**Sonia Koller:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Gorkan Ahmetoglu:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Ute Stephan:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization.

## Data availability

Data will be made available on request.

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## Appendix A. Venture description used in the SJT

### *A.1. Please use your imagination and put yourself in the context of the scenario*

Allison is the founder and CEO of a start-up building wearable technology intended to work in tandem with Virtual Reality environments. She aims to create products that enhance user experience and engagement by enabling users to have real-time, two-way interactions with the Virtual Reality environment.

Allison has previously worked in the tech industry. She has some limited resources to invest in the start-up from personal savings. Please use your imagination and put yourself into Allison's shoes; imagine how you would approach the following critical decisions Allison has to make during the early stages of setting up and growing her company.

For each decision, indicate your level of agreement with each of the options presented from 1 – Strongly Disagree to 5 – Strongly Agree.

**Appendix Table 1**
Decision scenarios and response option loadings (Study 1).

| Decision Scenarios | Response Options | C | AL | CC | LC | FM |
|---|---|---|---|---|---|---|
| 1.Allison knows she can't build and grow this company alone, so she needs to assemble a team to help her get started with the new venture. | Seek co-founders who commit time and resources to shape the future vision of the company | | | 0.50 | | |
| | Devise a very detailed business plan and hire contractors or employees to help you accomplish your business vision | 0.42 | | | | |
| | Invest time and resources into looking for the best people to hire within your team (R) | | −0.43 | | | |
| | Limit your and your team members' time and resource commitments, for example by working on the start-up as a side project or part-time job | | 0.49 | | | |
| | Engage low-cost workers or outsource work to enable you to have a low overhead and avoid overspending resources | | 0.52 | | | |
| 2. Allison is working on the specifications for her first product prototype. | Base prototype specifications on in-depth competitor analysis and positioning | 0.46 | | | | |
| | Start with a broad product vision and be open to making changes to the specifications as you move forward, for instance, in the event that ideas or resources change | | | | 0.55 | |
| | Base prototype specifications on your own and your team's personal experiences and preferences of design and functionality | | | | | 0.49 |
| 3. Allison is starting to think about the resources necessary for building an initial product prototype. | Build a detailed business plan and estimate the resources and costs associated with building the prototype | 0.63 | | | | |
| | Engage with potential customers before development starts and use their pre-orders to fund prototype development | | | 0.45 | | |
| | Search for investors to acquire the necessary funding for building a high-quality prototype | | | 0.52 | | |

(*continued on next page*)

**Appendix Table 1** (*continued*)

| Decision Scenarios | Response Options | C | AL | CC | LC | FM |
|---|---|---|---|---|---|---|
| 4. Allison is trying to figure out how to manage and allocate the funds she has available to invest in her start-up. | Build a financial plan projecting budgets for the main functional areas of the business requiring investment | 0.51 | | | | |
| | Only spend what is absolutely necessary at this stage, save the remainder for a rainy day | | 0.43 | | | |
| 5. Now that Allison has developed specifications for her prototype, she needs to decide which set of technologies to engage in the development of her prototype's software. | Look for technology partners that can help you design and build the technology infrastructure | | | 0.65 | | |
| | Rely on open-source technology as much as possible to keep development costs low | | 0.51 | | | |
| | Research your competitors' use of technology and look for a solution that allows you to create a distinct competitive advantage | 0.60 | | | | |
| | Choose an infrastructure based on your current capabilities and your team's expertise | | | | | 0.48 |
| 6. Allison's team is starting development work for the prototype, so she has to organize and manage the team's workload. | Carefully plan the team's activities for the upcoming period | 0.50 | | | | |
| | Experiment with and trial different ways of organizing the workload among the team | | | | 0.44 | |
| 7. On top of managing her team's workload, Allison needs to provide working space and computers allowing them to get started on development work. | Invest as little as possible by buying second-hand laptops for the team and organizing team working sessions or meetings in coffee shops and other public spaces | | 0.42 | | | |
| | Team up with local partners (such as business incubators or universities) who can provide access to these resources | | | 0.49 | | |
| 8. Allison is identifying and deciding between potential sources of revenue for her business, in particular whether to target enterprises or individual customers. | Evaluate expected returns from different sources of revenue | 0.50 | | | | |
| | Conduct detailed market analyses and use this data to decide which target customers you should focus on | 0.57 | | | | |
| 9. Allison is deciding which production modality to use so she can start fulfilling customer orders. | Choose the most affordable production mode that allows you to meet the basic product specifications | | 0.44 | | | |
| | Base your decision on a consideration of your past experience and network | | | | | 0.40 |
| | Search for a key stakeholder who is willing to share the risks | | | 0.56 | | |
| 10. Allison is working on developing her company's branding. | Invest in high-quality designs and marketing materials to create a strong company brand | 0.48 | | | | |
| | Establish partnerships with reputable organizations and individuals to benefit off their brand | | | 0.49 | | |
| | Focus on highlighting key differentiators from your competition's offering through your branding | 0.47 | | | | |
| | Devise a clear, well-defined branding strategy based on data about your target customer and their preferences | 0.47 | | | | |
| 11. Allison needs to start making decisions around how to market her product. | Rely on marketing methods that you, your team, or wider network are familiar with | | | | | 0.54 |
| | Devise a detailed marketing plan based on systematic customer segmentation and market research | 0.62 | | | | |
| | Experiment with different marketing methods | | | | 0.67 | |
| 12. Allison is working on getting her company's sales efforts off the ground. | Experiment with different sales methods | | | | 0.69 | |
| | Evaluate different sales strategies based on calculations of expected returns | 0.62 | | | | |
| | Devise a detailed strategy outlining sales targets and plans on how to achieve these targets | 0.69 | | | | |
| | Research your competitors' sales strategies and look for a strategy that will allow you to build competitive advantage over them | 0.63 | | | | |
| | Choose sales methods and channels that you or your team have previous experience with | | | | | 0.57 |
| 13. Allison starts thinking about identifying and creating new business opportunities for her company. | Develop a detailed plan for business development activities and set clear performance targets | 0.66 | | | | |
| | Calculate and evaluate expected returns from various opportunities to decide which ones to focus on | 0.62 | | | | |
| | Partner up with organizations targeting similar customers and create business opportunities together | | | 0.63 | | |
| 14. Allison is designing processes intended to facilitate entry into new geographical markets. | Co-opt local partners who can help you figure out local conditions and share the risks of expansion | | | 0.43 | | |
| | Experiment with various approaches in the local market | | | | 0.57 | |
| | Conduct in-depth research of local market conditions and plan a clear strategy | 0.68 | | | | |

(*continued on next page*)

**Appendix Table 1** (*continued*)

| Decision Scenarios | Response Options | C | AL | CC | LC | FM |
|---|---|---|---|---|---|---|
| 15. Allison needs to come up with some product ideas that would enable her to diversify her venture's offering. | Focus on existing means, resources or expertise within the team when generating new ideas for expansion | | | | | 0.42 |
| | Study expert predictions of where the market is heading to get ideas for expansion | 0.58 | | | | |
| | Establish partnerships that enable you to develop new products or services | | | 0.58 | | |
| | Experiment with different product ideas before deciding on a direction to pursue | | | | 0.61 | |
| | Produce calculations of potential returns for different ideas for products and services | 0.64 | | | | |
| | Focus on products or services that would allow you to further develop your competitive advantage | 0.47 | | | | |

*Note.* C = Causation, AL = Affordable Loss, CC = Co-creation, LC = Leverage Contingencies, FM = Focus on Means. Factor loadings <0.40 were omitted from the table.

## Appendix B. Common method variance bias analysis

Given the SJT measure is self-reported, we also assessed the potential presence of common method bias, as well as its impact on the reliability of our scales (Williams et al., 2010). Following best practice (Simmering et al., 2015), we included blue attitude as a marker variable. This is a 4-item measure that assesses individuals' attitudes toward the color blue. An example item is "I like the color blue.". The measure was developed specifically for use as a marker variable as it is not theoretically related to constructs typically of interest in organizational research. Furthermore, the items capture both affective and evaluative components of respondents' attitudes, which have been argued to be especially susceptible to biases associated with common method variance (Chan, 2009; Williams et al., 2010).

We evaluated the presence of common method bias using CFA. We compare a series of models that include the marker variable blue. We first tested a constrained model, where the effect of method biases is assumed to be uniform across all response options. A comparison between the baseline and constrained model indicated that the effects of method bias were unlikely to be uniform across all response options of the SJT ($\Delta\chi^2_1 = 0.002, p = .489$). We tested an un-constrained model where the effects of method bias on each of the options was estimated freely and was allowed to differ between options. The results revealed that on average, the methods factor accounted for less than 1 % of response option variance and 0.62 % of construct reliability. Appendix Table 2 shows the decomposition of reliability into substantive construct reliability and method-related reliability for each of the five scales of the SJT. Lastly, the comparison between the un-constrained model and a restricted model indicates that the presence of a small method bias does not affect the pattern of correlations between the different effectual and causal decision-making logics ($\Delta\chi^2_{10} = 0.012, p = .488$). In sum, this analysis suggests that common-method bias is unlikely to affect the reliability of our SJT.

**Appendix Table 2**
Reliability decomposition into substantive and method-related variance.

| | Reliability Baseline Model | Decomposed Reliability Unconstrained Model | | |
|---|---|---|---|---|
| Latent variable | Total Reliability | Substantive Reliability | Method Reliability | % Reliability Marker Variable |
| Affordable Loss | 0.81 | 0.81 | 0.00 | 0.04 |
| Co-Creation | 0.77 | 0.76 | 0.01 | 1.81 |
| Leverage contingencies | 0.80 | 0.80 | 0.00 | 0.80 |
| Focus on Means | 0.77 | 0.76 | 0.00 | 0.34 |
| Causation | 0.92 | 0.92 | 0.00 | 0.40 |
| Marker Variable | 0.80 | – | – | – |

**Appendix Table 3**
Regression results for models predicting venture outcomes from Chandler et al.'s (2011) scale self-report scores in Study 4.

| | Venture progress (t2) | Venture expenses (t2) | Venture funding (t2) |
|---|---|---|---|
| *Controls included* | | | |
| Causation (SR) (t1) | **0.28* (0.19)** | −0.12 (8660.11) | −0.15 (122,830.56) |
| Aff loss (SR) (t1) | 0.07 (0.16) | 0.04 (7599.57) | 0.06 (106,062.76) |
| Experimentation (SR) (t1) | −0.20 (0.13) | −0.01 (6213.88) | −0.16$^{\dagger}$ (87,767.40) |
| Flexibility (SR) (t1) | 0.16 (0.15) | 0.02 (6950.16) | 0.01 (98,016.00) |
| Pre-commitments (SR) (t1) | −0.01 (0.09) | 0.10 (4134.47) | 0.14 (58,018.10) |
| **$R^2$** | 0.26 | 0.64 | 0.60 |
| **Adjusted $R^2$** | 0.11 | 0.57 | 0.52 |
| ***F (p)*** | 1.78 (0.05) | 8.87 (< 0.001) | 7.51 (< 0.001) |

*Note.* SR = Self-report. Standardized regression coefficients are shown; standard errors in parentheses. The coefficients for the control variables were left out of the tables for brevity. They are available by request from the first author. $N = 93$.
$^{\dagger}$ Significant at $p < .10$; *significant at $p < .05$; ** significant at $p < .001$.

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