

# Toward a Comprehensive Measure of Entrepreneurial Mindset

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## Abstract

### Objective

Our objective is to build a comprehensive measure to assess the “entrepreneurial mindset.” It is first important to note that this is not the old “entrepreneurial personality” wine in a new and more attractive bottle. In our view, “mindset” includes elements traditionally considered to be narrow personality traits, elements that are broad personality dispositions, elements that are much more typically considered cognitive processes, and still others that are behavioral dispositions rooted in interactions with other people. To keep our arguments clear, we treat these influences on behavior as if they were independent of one another.

### Prior Work

Interest in the psychological characteristics of entrepreneurs grows naturally from recognition that (a) not all people elect to pursue that career path, and (b) not all who do attain equal measures of success. Why do these differences exist? Psychological approaches include one based on personality characteristics, one based on sociocognitive processes, and one based on motivation. The personality approach includes single traits such as locus of control (Phares, 1971; Rotter, 1966), risk propensity (Jackson, Hourany, & Vidmar, 1972), self-efficacy (Bandura, 1977, 1986, 2012); as well as broad personality dimensions such as Big Five (Costa & McCrae, 1992) or HEXACO (Lee and Ashton, 2004). The sociocognitive approach describes such things as heuristics, attributions, schemata, and metacognition (see for example, Arend, Cao, Grego-Nagel, Im, Yang, & Canavati, 2016; Baron & Ward, 2004; Grégoire, Corbett, & McMullen, 2011; Grégoire, Cornelissen, Dimov, & van Burg, 2015; Mitchell, Busenitz, Lant, McDougall, Morse, & Smith, 2004; Mitchell, Busenitz, Bird, Gaglio, McMullen, Morse, & Smith, 2007). Motivational factors include such things as achievement (Carsrud, Brännback, Elfving, & Brandt, 2017; McClelland, 1961), entrepreneurial passion (Cardon, Grégoire, Stevens, & Patel, 2013), or reasons for starting (Carter, Gartner, Shaver & Gatewood, 2003; Scheinberg & Macmillan, 1988).

### Approach

Despite this extensive literature, and the presence of several trait-based measures (Caird, 1990; Cassidy & Lynn, 1989; Davis, Hall, & Mayer, 2016; Robinson, Stimpson, Huefner, & Hunt, 1991) there is still a need for a comprehensive test of entrepreneurial mindset incorporating motives, intentions, and behaviors, as well as the more typical psychological predispositions. A comprehensive literature review (Commarmond, 2017) identified 76 nuanced conceptions having to do with entrepreneurial action. Eliminating redundancies reduced this list to 37 separate constructs. A total of 116 Likert-type items was created by adopting elements of published scales, deriving questions from illustrations of published constructs, and where necessary writing new items. The 116 were administered in a pilot study to 400 randomly selected respondents in South Africa.

### Results

A series of factor analyses reduced the number of items and revealed important differences in the factor structures of women and men. The work is continuing with a validity sample of 2,350 randomly selected respondents and an additional 1,000 respondents randomly selected from national lists of entrepreneurs. We expect that the eventual outcome will be a set of dimensions that can be used to characterize the entrepreneurial mindset.

# Toward a Comprehensive Measure of Entrepreneurial Mindset

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## Introduction

The first two criticisms applied to any work that describes a new measure of entrepreneurial propensity are “Why bother? Individual differences don’t matter!” and “We already have such measures, why are you proposing a new one?” One hopes that the two questions do not originate from within the same critic, because if the first one happened to be correct, there would be no point in asking the second one. It is certainly true that situational influences on entrepreneurial are strong, but only the most hardened behaviorist in the Skinnerian tradition (see for example, Skinner, 1938) would discount personal variables completely. On a more practical level, it is worth noting that investors who consistently “bet on the jockey, not on the horse” are clearly acting as though they believe individual differences matter. Moving to the second question, there are existing measures of entrepreneurial propensity, such as those by Caird (1990), Cassidy & Lynn (1989), Davis, Hall, & Mayer (2016), and Robinson, Stimpson, Huefner, & Hunt (1991). We believe, however, that none of these captures the full breadth of individual differences that can be said to constitute the “entrepreneurial mindset.” We hope that when readers finish this paper, they will agree.

## Literature Review

One of the most persistent questions in entrepreneurship research is “why do some people become entrepreneurs, but others do not?” or a more refined version, “why do some entrepreneurs achieve great success, but others do not?” The search for explanations is challenging. For every example of a person who intentionally created a company to solve a very large problem, there is an example of a person to whom great success “just happened.” Many social psychologists are fond of situational explanations, arguing that the power of circumstances should be paramount, whereas many personality psychologists favor dispositional explanations, arguing that the outcome should be attributed to inherent properties of the person.

In the literature this debate is well over 40 years old, with a situational position outlined by Mischel (1968) that contrasts with a prior emphasis on individual traits (e.g., Allport, 1937). Unhappy with either pure situationism or pure trait-based approaches, Bowers (1973) argued persuasively that the truth was really somewhere in the *interaction* between person and situation. When situational demands are strong, there will be substantial uniformity of behavior among individuals; when the situational demands are weak, person variables will rise in importance. (As an aside, even when the situational demands are pretty strong, some individuals appear to ignore them: Witness the number of people who steadfastly believe – against an almost uniform scientific consensus – that global warming is a hoax.) Not surprisingly, a version of the person-situation debate has appeared in entrepreneurship. Gartner (1988) argued that a pure trait approach should be replaced with a concentration on behavior and activities. Aldrich (1990) focused on environmental conditions, arguing from an ecological perspective that “rates” would be more fruitful than traits. Shaver (1995) argued against a specific set of characteristics that would constitute an “entrepreneurial personality,” but Rauch & Frese (2007) countered that it was time to return to the study of traits. Our view of this debate is, obviously, that individual differences do matter, but that it is important to be inclusive in the nature and kind of such variables that are considered.

There is no shortage of individual difference variables (single personality traits, broad personal dispositions, cognitive processes, personal motives, reasons for acting) that have implicated in entrepreneurial behavior. Some of the single traits include achievement motivation (McClelland, 1961), locus of control (Phares, 1971; Rotter, 1966), risk propensity (Jackson, Hourany, & Vidmar, 1972), and desire for autonomy (van Gelderen, 2016). Among the broad personality dimensions are the Big Five

(Costa & McCrae, 1992; Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes, 2004) or, less frequently, three (Eysenck & Eysenck, 1975), or six (Lee and Ashton, 2004). The Big Five are Openness to experience, Conscientiousness, Extraversion, Agreeableness, and Neuroticism (here arranged in one of the common mnemonic orders, OCEAN). In a meta-analysis of 23 separate studies, Zhao and Seibert (2006) found that compared to managers, entrepreneurs were higher on conscientiousness and openness to experience and lower on neuroticism and agreeableness.

Turning to approaches that are more considered to involve cognitive processes rather than personality dimensions, there have been two complete issues of *Entrepreneurship Theory & Practice* on the topic (Mitchell, Busenitz, Lant, McDougall, Morse, & Smith, 2004; Mitchell, Busenitz, Bird, Gaglio, McMullen, Morse, & Smith, 2007). Some of the approaches based on cognitive processes are the use of entrepreneurial intentions (Krueger, 2009, 2015; Krueger & Carsrud, 1993), expectancies (Gatewood, 2004; Renko, Kroeck, & Bullough, 2012), judgment of risk (Palich & Bagby, 1995), escalation of commitment (McMullen & Kier, 2016; Staw & Ross, 1987), beliefs in whether an individual's characteristics are fixed or malleable (Dweck, 2006), attributions (Diochon, Menzies, & Gasse, 2007; Gartner, Shaver, & Liao, 2008), overconfidence (Cain, Moore, & Haran, 2015; Cooper, Dunkelberg, & Woo, 1988; Nielsen & Sarasvathy, 2016), and reasons for starting a business in the first place (Carter, Gartner, Shaver, & Gatewood, 2003; Scheinberg & MacMillan, 1988). The list could continue, but this is sufficient to make the point that psychological processes other than personality dimensions might well have something to do with entrepreneurship and entrepreneurial success.

Finally, there are person variables that arguably are influenced by situational factors. Perhaps the best known of these is self-efficacy (Bandura, 1977, 1986, 2012) which, though often considered among the "personality" variables, has features that make it more appropriately described as interactional. First, it is grounded on Bandura's social learning theory – a central tenet of which is learning from the *observation* of others. Second, it is domain-specific. This is the virtual antithesis of a true personality variable expected to operate in roughly the same fashion regardless of the circumstances. Third, although there is a distribution of self-efficacy across individuals, specific training can shift the mean of this distribution. There are other characteristics, which we call "personality variables" for convenience, that technically arise from an interaction between person and situation. One of these is entrepreneurial passion, which, according to Cardon, Wincent, Singh, & Drnovsek (2009) "is not aroused because some entrepreneurs are inherently disposed to such feelings but, rather, that because they are engaged in something that relates to a meaningful and salient self-identity for them (p. 516). Another is grit (Duckworth & Quinn, 2009), defined as "trait-level perseverance and passion for long-term goals" (p.166). Despite Duckworth's treatment of grit as a lasting individual difference variable, she and Quinn found that grit scores increased with age, which "suggests that grit may increase with life experience" (p, 169). At least in this limited sense, it would seem reasonable to consider grit located in the person-situation interaction.

Back when social and personality psychology were attempting to elucidate the person-situation interaction, one explanation for a low correlation between personality characteristics and behavior was a methodological one. Remember that a true "trait" is expected to influence a wide variety of behaviors, especially in circumstances where the situational pressures are weak. But as Epstein (1979, 1984) pointed out, most research of the day collected one measure of the personality trait and then examined behavior in only one setting. This is somewhat less of a problem in entrepreneurship, provided that the various behaviors associated with the entrepreneurial role are assessed separately (and if possible, over time). A second explanation that is especially relevant for present purposes is the idea of *template-matching* (Bem & Funder, 1978). This approach assumes that the correlation between a personality dimension and a behavior will be high only if the individual's personality characteristic matches the template inherent in the situational requirements for the behavior. If this sounds familiar, it should. The Ciavarella, Buchholtz, Riordan, Gatewood, & Stokes (2004) study found that conscientiousness was positively related to venture survival. There was, however, an unanticipated negative relationship between openness to experience and long-term venture survival. In short, the environmental template for venture survival may call for conscientiousness, but excess openness to experience might lead the entrepreneur to squander resources on goals that are too tangential to the operation of the primary business.

We take seriously the idea that a comprehensive approach to measuring entrepreneurial mindset must (a) assess cognitive processes and behavioral tendencies as well as traditional personality traits, and (b) do so while paying attention to the varied roles that an entrepreneur might play. We hope that a comprehensive measure of entrepreneurial mindset would have uses well beyond that of testing people who are already engaged in entrepreneurial business. Specifically, for example, we would hope it could prove useful in distinguishing people who have significant entrepreneurial propensity from those who do not. We hope it would also be helpful in identifying the attitudinal and behavioral outcomes of entrepreneurial education initiatives.

Recently, Commarmond (2017) has written a comprehensive review of the literature regarding entrepreneurial mindset that is too detailed to be included here. His review begins with the early trait theories of McDougall (1932) and Allport (1937), Cattell (1947, 1957), and Fiske (1949) and continues to describe both the Big Five (Costa & McCrae, 1976; 1985) and the more recent HEXACO model of six basic factors (Ashton & Lee, 2008). Some of the other approaches that Commarmond considered are Dweck's entity/incremental mindset (Dweck, 2006; Dweck, Chiu, & Hong, 1995), regulatory focus (Higgins, 1998), and self-monitoring (Snyder, 1974). In his review Commarmond identified 11 key themes that characterize an entrepreneurial mindset. These are lifelong learning and openness to change, engagement in a complex and uncertain world, creativity and innovation, belief in one's own capacity, desire to behave entrepreneurially, the taking of initiative and responsibility for one's actions, pursuit of goal attainment and mastery, recognition of opportunities, grit and perseverance in the face of challenges, taking of acceptable risks, and belief in one's ability to influence others. At the level of single concepts, these themes overlap to a substantial degree with the elements included in other lists of entrepreneurial characteristics. For example, Cromie (2000) suggested seven core attributes – need for achievement, locus of control, calculated risk-taking, tolerance for ambiguity, creativity, need for autonomy, and self-confidence. Baron's (2004) paper on cognitive processes in entrepreneurship mentioned such things as prospect theory (Kahneman & Tversky, 1979), greater susceptibility to various cognitive biases, regulatory focus (Higgins, 1998), and counterfactual thinking (Epstude & Roese, 2008). Other cognitive processes such as schemata (Bartlett, 1932) congenial to the identification of entrepreneurial opportunities and aspects of metacognition (Gollwitzer & Schaal, 1998) should probably also be considered. Krueger's (2015) "crowd-sourced" list includes action orientation, innovativeness, resilience, persistence, self-efficacy, role identity, entrepreneurial intensity, tolerance for ambiguity, risk acceptance, future orientation, market orientation, value creation, entrepreneurial intentions, and entrepreneurial behavior.

## **Existing Scales**

Even this abbreviated review illustrates the broad variety of conceptual principles that have been suggested as possible elements of an entrepreneurial mindset. We believe that existing scales, often designed with particular objectives in mind, do not adequately capture the very large and diverse list of constructs that might be offered as explanations for entrepreneurial behavior. First there are the easily-located online tests for which there are no reported measures of reliability or validity. These include the Entrepreneurial Personality Test (37 items) offered by *Psychology Today* on the basis of Wagner & Gitomer's book, *The entrepreneur next door* (2006); the *Forbes* Entrepreneurial Instinct Test (31 items) based on Harrison & Frake's book *Instinct: Tapping your entrepreneurial dna to achieve your business goals* (2005), which claims to use the Big Five; and the BOSI-DNA based on Joe Abraham's book, *Entrepreneurial DNA: The breakthrough discovery that aligns your business to your unique strengths* (2011). We shall not discuss these further.

Of the scales that appear in the professional literature, one important early entry was an attitude approach to predicting entrepreneurial behavior designed by Robinson, Stimpson, Huefner, & Hunt (1991). This Entrepreneurial Attitude Orientation (EAO) scale took seriously the view in social psychology that attitudes consisted of three components (cognitive, affective, behavioral). The EAO contained four subscales – achievement in business, innovation in business, perceived personal control over business outcomes, and perceived self-esteem in business. Each subscale contained a cognitive component, an affective component, and a behavioral component. The items in the EAO are themselves

very sensible, but the fact that the test as a whole was so closely tied to the concept of a social attitude limits the reach of the scale.

At essentially the same time the EAO appeared, Caird (1990) developed a General Enterprising Tendency (GET) scale at the Open University in the UK. A more recent version (the GET2, Caird, 2017) is available online ([www.get2test.net](http://www.get2test.net), accessed September 29, 2017). It uses 54 agree/disagree items to assess achievement, autonomy, creativity, risk-taking, and locus of control. With the GET2, the primary limitation is the restriction to only five of the many constructs that have been suggested as possible contributors to entrepreneurial activity.

A third test was created by the Assessment Tools and Indicators for Entrepreneurship Education (ASTE) project in the EU, whose entrepreneurship education items are now administered solely via an app called OctoSkills from the Danish Foundation for Entrepreneurship, designed to allow teachers to assess outcomes of entrepreneurship education courses. A fourth general survey is the Global University Entrepreneurial Spirit Students' Survey (GUESSS), an international research project now coordinated by Phillip Sieger at the University of St. Gallen. This project is derived from the Theory of Planned Behavior (Ajzen, 1985) and concentrates on the entrepreneurial intentions of students. Among the individual-level constructs assessed are personal motives, preferences, and social identity. Because both OctoSkills and GUESSS are intended for student samples and entrepreneurial education initiatives, they are less likely to be broadly useful.

Finally, there is the Entrepreneurial Mindset Profile (EMP, Davis, Hall, & Mayer, 2016). These investigators began with 14 dimensions, some based on prior literature (e.g., four from a model of creativity by Torrance, 1968) and some based on the authors' discussions with entrepreneurs. Seven of the dimensions were regarded as "skills," on the assumption that they could be modified by training or experience, whereas the other seven were regarded as "personality traits" not as susceptible to change. The personality traits include independence, risk acceptance, action orientation, achievement, nonconformity, preference for limited structure and passion; the skills include future focus, idea generation, execution, self-confidence, optimism, persistence, and interpersonal sensitivity. (It may be worth noting that other investigators consider personal characteristics like optimism, persistence, or interpersonal sensitivity to be much more like personality traits than like skills.) The authors administered 118 items assessing the 14 dimensions to a convenience sample of 300 people, then used exploratory factor analysis (EFA) to examine the dimensions. Nine dimensions clearly emerged, and then the authors created a second version that clarified some of the prior dimensions and added others. In the second version there were between 7-10 items for each of 14 scales, and these items were administered to another convenience sample of 725 individuals, many of whom had been recruited through connections between their companies and the leadership institute with which two of the authors were affiliated. To create the final version of the 14 scales, the authors chose the five highest-loading items on each scale. This version was published online, and data are reported for 1,872 individuals who completed the final version, some online (for a fee), others as part of either a management training program or a university course. The authors report adequate reliability and validity (Davis, Hall, & Mayer, 2016) with most scales showing differences between self-identified entrepreneurs and others in the sample. Although the authors report small mean differences between women and men on several of the scales, they did not report factor structures separately by respondent sex.

### **Scale Development**

The limitations inherent in existing instruments suggest that there would be value in creating a conceptually comprehensive test of entrepreneurial mindset. Commarmond's (2017) literature review identified 76 separate descriptors of characteristics that have been considered to be related to entrepreneurial behavior. These 76 characteristics are shown in Table 1, with the number of references to the characteristic shown in parentheses in each cell.

Table 1. List of characteristics associated with an entrepreneurial mindset.

Ability to exploit contingencies (1)	Independence (2)
Achievement orientation (1)	Initiative (2)
Action orientation (2)	Innovation (2)
Adaptability (2)	Insane hunger to succeed (1)
Ambition (2)	Internal locus of control (4)
Antagonism (1)	Interpersonal sensitivity (1)
Autonomy (1)	Iterative (1)
Benefiting others (1)	Learns from criticism (1)
Calculated risk-taking (1)	Malleable behaviour (1)
Conscientiousness (2)	Mastery-orientated (3)
Consistent passion and interest (1)	Mediational judgement (1)
Context of relevance: More dynamic, nonlinear, and ecological (1)	Motivation (3)
Contextual goal-orientation (1)	Nature of the unknown: Focus on the controllable aspects of an unpredictable future (1)
Creativity and imagination (3)	Need for achievement (3)
Curiosity (1)	Need for empowerment (1)
Dealing with uncertainty (1)	Neuroticism (1)
Decision Making: Decisions made by what one is willing to risk (1)	Nonconformity (1)
Decision Making: Explores what else could be possible with given means (1)	Open to collaborate and partner (1)
Decision Making: Focused on the process and adaptable learning journey (1)	Open to feedback (1)
Desire to influence others (3)	Open to experiences (1)
Determination (2)	Opportunity recognition (2)
Dynamism and complexity (1)	Optimism (1)
Effectual (1)	Passionate (2)
Effort-oriented (2)	Passion for entrepreneurship (1)
Embrace challenges (1)	Persistence (4)
Entrepreneurial identity aspiration (1)	Planning ahead (1)
Entrepreneurial intention (1)	Preference for a limited structure (1)
Entrepreneurial motivation (1)	Probabilistic (1)
Entrepreneurial self-efficacy (3)	Recognise Patterns and Linkages (1)
Extraversion (1)	Reflective (1)
Feeling of empowerment (1)	Resilience (1)
Finds lessons and inspiration in the success of others (1)	Resourcefulness (2)
Flexibility (2)	Responds rather than reacts (1)
Future focused (1)	Risk-orientation (4)
General self-efficacy (3)	Self-belief and self-confidence related (6)
Goal-oriented (1)	Tenacious (1)
Goals set for learning sake (1)	Tolerance for failure (3)
Idea generation (1)	Underlying logic: To the extent we can control the future, we do not need to predict it (1)

Given the diversity of disciplines that have contributed to the entrepreneurship literature, it is not surprising that the descriptions – which Commarmond attempted to keep close to the original – do not all sound like “standard” personal characteristics. Additionally, there are some obvious overlaps. We expect that any author team would reduce this list of 76 separate descriptions to a much shorter list of personal characteristics. Our reduced list is shown in Table 2, and contains 37 descriptors, some of which are akin

to personality traits, others of which are descriptions of behavior, and still others reflect an entrepreneur's personal preferences.

Table 2. A reduced list of personal descriptive terms.

action orientation	metacognition
adaptability	need for achievement
coachability	need for autonomy
conscientiousness	neuroticism (stability)
creativity	nonconformity
curiosity	norms
drive	openness to experience
effectuation	opportunity recognition
effort	optimism
emotional intelligence	passion
entrepreneurial intentions	perception of failure (resilience?)
entrepreneurial self-efficacy	persistence
financial goals	personal goals
focus	planning
general self-efficacy	resourcefulness
growth/fixed mindset	risk acceptance
innovation	self-confidence
leadership	self-reliance
locus of control	

Even with a dramatically reduced list of terms, there is the danger that distinctions that seem important to experts in any field may not reflect practical differences that are important for others. It is important for Eskimos to have 50 different "words" for snow, but for a person attempting to clear a drift away from a front door, the only distinction that might matter is whether the snow is wet and heavy or dry and light. It is our expectation that the statistical analyses to be conducted by the completion of this project will likely reduce the effective number of dimensions still further.

Entrepreneurs are almost notoriously short of available time, so an overarching constraint was to keep a final survey short enough that response rates would be high. For a survey in written form, experience suggests that a respondent can answer a single Likert-type item in roughly 7 seconds. At this rate, a total of 75-80 items could be answered in under 10 minutes time, allowing a wide variety of concepts to be assessed. On the other hand, the time limit dictates that essentially no single construct can be measured by a "complete" scale. (The Paulhus, 1983, Spheres of Control scale, for example, contains 30 items all by itself.) As a result of the time limitation the research strategy involved four steps. For some of the constructs we were able to use items from published scales that had been used with entrepreneurs, and in that instance we selected the two (or sometimes three) items with the highest listed factor loadings. We followed the same procedure when it came to scales measuring concepts related to entrepreneurship, but which concepts had not yet been tested with entrepreneurial respondents. Next, some of the concepts related to entrepreneurship do not offer publicly available scales, but do provide one or two items that we were able to use as a starting point. Finally, some dimensions that have been suggested as part of the entrepreneurial mindset have neither publicly available scales nor single items that can be used as a place to begin. For these dimensions, we independently wrote items, compared the results, and settled on a wording to be employed. Together these methods produced a total of 116 items.

### **Pilot Study**

With the sponsorship of the Allan Gray Orbis Foundation of South Africa and the GEN Global organization, the pilot study was conducted in South Africa in the late spring of 2017. The field research was accomplished by an exceptionally well-regarded South African market research firm, African

Response<sup>1</sup>. Based on the senior author's experience with the US Panel Studies of Entrepreneurial Dynamics (PSED), it was expected that a total of 400 respondents (200 female, 200 male) would be sufficient for the factor analyses to be performed. In this pilot project the only objective was to create a reliable reduced set of dimensions from the original 116 items. Consequently, there was no attempt to assess the measure's validity by comparing the responses of entrepreneurs to those of people who did not occupy an entrepreneurial role. South Africa is an excellent place to conduct such a pilot study, because the country has 11 official languages and 4 major racial groups (Black, Colored, Indian, and White). The pilot study was conducted in three metropolitan areas – Cape Town, Durban, and Johannesburg – by field interviewers thoroughly trained by African Response. Although the survey was conducted in English, each field interviewer was fluent in the local language spoken in the particular area to which the interviewer was sent. (Feedback from the interviewers indicated that only rarely was a local translation needed, and then only for occasional words.)

Within the three metropolitan locations, census data were used to identify Enumeration Areas (EAs, basically, local census tracts) selected by stratified random sampling to take the local population probability proportional to size (PPS) into account. Within each EA, households were selected according to a Kish grid. There were three repeat visits before any substitution was permitted, and had substitution been required, the procedures for accomplishing that substitution were specified in advance. Once a household had been selected, the person who answered the door was first asked to enumerate all of the residents of the household, and a Kish grid was used to select the target respondent from among the residents (with the restriction that residents under age 18 were not selected). Interviewers used tablets to collect the data. Every interviewee received the 116 items in a different random order, responses were made in a Likert format (Strongly Disagree to Strongly Agree, scored as a 6-point scale), and a concerted effort was made to avoid missing answers. Data were encrypted by the tablets and stored in the cloud.

*NOTE: As this document is being written, a validity study is underway, also conducted by African Response. This validity study will use a random sample of 2,350 plus an additional sample of 1,000, with the latter chosen because of their involvement in entrepreneurial business.*

## Results

On the basis of random selection (no quotas) the pilot study completed interviews with 183 males (46%) and 217 (54%) females. National averages for sex are, respectively, 49% and 51%. Basic demographic data for this sample of 400 people are shown in Table 3 (national averages are shown in parentheses).

Table 3. Substitutions required and demographic information.

Province	Not successful on first visit	Household substituted
Gauteng (Johannesburg, <i>n</i> = 200)	15.6%	13.6%
KwaZulu-Natal (Durban, <i>n</i> = 100)	28.7%	22.8%
Western Cape (Cape Town, <i>n</i> = 100)	8.0%	5.0%
TOTAL	17.0%	13.8%
Racial Group	Mean Age	% of Sample
Black	38.64 (35.38)	60.50 (69)
Colored	39.14 (39.68)	18.00 (18)
Indian / Asian	44.11 (41.23)	6.80 (4)
White	50.07 (37.84)	14.80 (15)

Although the mean ages might appear high, they are not that far displaced from the national averages, and across the entire sample, 64% of respondents were age 44 or younger.

<sup>1</sup> Our sincere thanks to Jan Wegelin, the Head of Research for African Response, for his first-rate leadership of the actual pilot project design and data collection effort.



As a preliminary to the factor analyses, we conducted both the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy and the Bartlett's test of sphericity. The KMO tests for the proportion of variance that might be common (more is better for factor analysis), with higher numbers better. The KMO values were .94 for the 217 females and .90 for the 183 males, and values between .90 and 1.0 are considered excellent. The Bartlett's test assesses the null hypothesis that there are no differences in variances of individual items. The result is given as a Chi-square value with  $(p*(p-1))/2$  degrees of freedom. The value for females was 22, 508.99 and for males was 17, 124.38, both highly significant. Because females and males might have produced different factor structures, we analyzed them separately.

SPSS offers six possible methods for factor analysis: principal components analysis (PC), unweighted least squares (ULS), general least squares (GLS), maximum likelihood (ML), principal axis factoring (PAF), alpha factoring (AF), and image factoring (IF). According to Youngblut (2013), PC assumes that all error is random, so extracts "real" factors inherent in the data (a geometrically correct result), whether or not that result is related to the original constructs. This is one reason that PC is said to produce "components" rather than "factors" (Nunnally, 1978). The other methods do not assume that all error is random, but leave open the possibility that some error might be systematic. Because of differences in the assumptions about error, the conservative course of action is to compare the results of PC to the results of some other extraction technique. Because ULS "does not require any distributional assumptions. It can be used with small samples even when the number of variables is large..." (Jöreskog, 2003, p. 1), it is our choice for an alternative to PC.

The analysis strategy for the pilot study was to attempt to accomplish three goals to the extent possible, recognizing that achieving one goal might well reduce the likelihood of achieving another. The first goal was to reduce the number of conceptual dimensions from the initial 42 to some much smaller number (the DIM) column in Table 1. The second goal was to account for as much of the variability in the data as possible (the PCT column in Table 1). The third goal was to rotate the factor structure in  $n$ -dimensional space to maximize the loadings and enable better identification of the underlying factors.

At least two of these goals are in conflict: fewer factors will necessarily explain less of the variance. The amount of variance explained by a factor is its *eigenvalue*, and most statistical programs cause a factor analysis to terminate with a minimum eigenvalue of 1.0, the value equivalent to a single item. Note that the termination rule is arbitrary: raising the eigenvalue criterion will reduce the number of factors produced in the analysis. As for the rotation, there are several methods that can be used. According to Darton (1980), the first mathematical approach to rotation of factors was produced by Carroll (1953) and its algorithm worked to simplify the rows of the pattern matrix by minimizing the cross-product term. Darton goes on to say that this is equivalent to "maximizing the term of fourth powers" (p. 180), which is why the method is called *quartimax*. The quartimax procedure "tends to retain an important first factor" (p.180). *Varimax* rotation (Kaiser, 1958), which attempts to simplify columns rather than rows, "is a recommended rotation technique to use when you start exploring the dataset" (Yong & Pearce, 2013, p. 86). The varimax procedure maximizes the sum of the squared factor loadings and because it attempts to simplify columns, in theory it "precludes the retention of a fairly general first factor" (Darton, 1980, p. 181). Because the two rotation methods might have different implications for the first identified factor, we used both.

We first performed a series of PCA and ULS factor analyses (separately for females and males) with several different eigenvalue criteria: 1.0, 1.2, and 1.3. As it happened, minimum eigenvalue of 1.2 produced the most easily interpretable outcome. With this eigenvalue, the number of identified factors for males was 20 and the number of identified factors for females was 13, regardless of whether the analysis had been PCA or ULS. Solutions for females were always successfully rotated (both quartimax and varimax) and solutions for males were successfully rotated by quartimax regardless of extraction method. Varimax rotations for males failed regardless of extraction method.

One rule of thumb is that to be retained an item should have a primary loading in excess of  $\pm 0.4$  and no cross-loading that exceeds  $\pm 0.4$  (though Costello & Osborne, 2005, suggest that no cross-loading should exceed  $\pm 0.32$ ). Thus in many circumstances, one simply retains items that have high enough primary

loadings without being compromised by too-high cross-loadings. Our initial strategy was to do just this, using each of the eight algorithms described above (PC/ULS by Varimax/Quartimax separately for Females and Males). In each of these analyses we counted the number of items with no cross-loadings above an absolute value of 0.32, and identified the specific factor on which each such item loaded. As Table 4 below shows, however, despite the high number of factors revealed in each analysis, the number of primary items loading on some factor *other than the first* was exceedingly small. This suggested that there might be very little variability within the items, notwithstanding the significant KMO and Bartlett tests.

Table 4. Primary and cross-loaded items by analysis type.

Sex of Respondents:	Females				Males			
Type of factor analysis:	PC		ULS		PC		ULS	
Nature of rotation:	Q	V	Q	V	Q	V	Q	V
Cross-loaded items	40	66	30	56	40	23	33	14
Items on Factor 1	75	38	85	47	71	92	77	101
Items on all other factors	1	12	1	13	5	1	6	1

PC= Principal Components Analysis  
 ULS= Unweighted Least Squares factor analysis  
 Q= Quartimax rotation  
 V= Varimax rotation

Indeed, the data in Table 4 suggest that instead of the usual case that cross-loaded items are “unclear,” it might be that the cross-loaded items were the only ones with sufficient internal variability to appear on some factor other than the first one. To assess this possibility, we looked at the mean and variance for each of the 116 items. Despite the fact that every item had a score range from 1 to 6, the mean scores of nearly all items were around 5.0 (there were only 3 items with a mean score less than 4.6). The actual values ranged from 4.47 to 5.23 with an overall average of the 116 items = 5.00. Given the mean scores, the standard deviations of items were also restricted, ranging from 0.91 to 1.57, with an overall average  $SD = 1.11$ . To determine whether the items with higher standard deviations were in fact the ones that had cross-loaded, we counted the number of analyses (out of the 8 in Table 4) in which an item had been cross-loaded, and then correlated that number with the standard deviation of the item. The result of this Pearson correlation was highly significant with  $r_{(114)} = 0.64, p < .0001$ . In short, the higher the standard deviation of an item, the more analyses in which it was cross-loaded.

Examination of the content of the cross-loaded items revealed that many of them had originated from publicly available (and previously tested) scales for measuring entrepreneurial potential. Consequently, rather than eliminate these items, we elected to factor analyze them. We included in these analyses any item that had been cross-loaded 3 or more times (so that the item had to be cross-loaded either for both sexes or in more than one analysis/rotation combination). Factors emerging from principal components analyses (varimax rotation) of these 48 items are shown in Table 5 for both female and male respondents.

Table 5. Factor structures for females and males on 48 items.

217 female respondents						
(KMO = .91; Bartlett = 4511.69) Factor:	I	II	III	IV	V	
Rotation % of variance accounted for:	16.48	13.31	12.20	8.09	5.90	
Cronbach alpha for scale:	.92	.91	.92	.86	.77	
183 male respondents						
(KMO = .91; Bartlett = 4511.69) Factor:	I	II	III	IV	V	VI VII
Rotation % of variance accounted for:	14.49	9.87	8.46	8.30	6.09	3.78 3.68
Cronbach alpha for scale:	.90	.88	.82	.85	.72	NA .34

Now instead of the large number of factors (13 and 20) obtained when analyzing the entire set of 116 items, the number was reduced to five for females and seven for males (although for males, factor VI consisted of a single item).

Having been able to produce rotated factor structures with the 48 items with the highest item standard deviations, we turned to the 30 items next in descending order of size of standard deviation. Rather than use some form of content criterion for how to create this group of variables to analyze, we simply stopped as soon as the standard deviations dropped below 1.06. The resulting 30 items were also subjected to PC extraction with varimax rotation and the results are shown in Table 6. Interestingly, these analyses produced only two dimensions for female respondents and two dimensions for male respondents, with both rotations converging in only 3 iterations. In both cases all 30 items appeared in the two dimensions (but, as before, there was less than complete overlap in the items present in a dimension for females and the same dimension for males). Because there was no expectation that these 30 items would be used by themselves, no Cronbach reliabilities were computed for the scales that comprised each factor.

Table 6. Factor structures for females and males on 30 items.

217 female respondents		
(KMO = .96; Bartlett = 4237.79) Factor:	I	II
Rotation % of variance accounted for:	31.55	23.57
183 male respondents		
(KMO = .95; Bartlett = 2997.81) Factor:	I	II
Rotation % of variance accounted for:	30.33	18.50

The next factor analysis performed was on the last 38 items – the ones with the lowest standard deviations. Again the extraction method was PC and the rotation method was varimax. Results for the two analyses are shown in Table 7. This time for females only one dimension appeared (so rotation was not possible).

Table 7. Factor structures for females and males on 38 items.

217 female respondents			
(KMO = .97; Bartlett = 6264.04) Factor:	I		
Rotation % of variance accounted for:	54.56		
183 male respondents			
(KMO = .96; Bartlett = 4322.98) Factor:	I	II	III
Rotation % of variance accounted for:	19.06	18.89	16.04

At this point the challenge is to identify the “best” (read, least compromised by cross-loadings) items inherent in all three prior analyses. To accomplish this end, we identified each item in each analysis that had produced only one primary loading (i.e., no cross-loadings) in any dimension for females that had also produced only one primary loading in *some* dimension for males. We counted separately the items that had produced only a primary loading for both sexes on the same numbered factor. The results are as follows. For the 48-item analyses, there were 23 items with only a primary loading for both females and males and an additional 6 items where the primary loadings were on the same numbered factor (total of 29). For the 30-item set, there were 3 that produced only a primary loading for both sexes, and another 7 where the primary loading was on the same numbered factor (total of 10). For the 38-item set, there were 16 with a primary loading for both sexes and another 7 where the primary loading was on the same numbered factor (total of 23). Together this created a group of 62 items that had individually produced only primary loadings. This group of 62 was then subjected to PC analysis with varimax rotation. Results of the analysis are shown in Table 8.

Table 8. Factor structures for females and males on 62 items.

217 female respondents							
(KMO = .92; Bartlett = 6937.36) Factor:	I	II	III	IV	V		
Rotation % of variance accounted for:	24.65	10.57	8.92	7.99	6.47		
Cronbach alpha for scale (CL retained):	.97	.92	.88	.87	.78		
183 male respondents							
(KMO = .92; Bartlett = 6937.36) Factor:	I	II	III	IV	V	VI	VII
Rotation % of variance accounted for:	15.73	9.37	7.44	5.66	5.58	5.38	3.58
Cronbach alpha for scale (CL retained):	.95	.88	.89	.69	.76	.74	.58

As in the case of all analyses, this set performed on 62 items showed different factor structures for women and men. Sex differences have previously been obtained in more than a few studies of entrepreneurship, so it is not surprising to find them here as well. The difficulty faced in the first attempt to analyze all 116 items at a time is probably the consequence of not having sufficient numbers of respondents. It had been reasonable – using the PSED results as a guide – to suggest that 2X the number of items per sex would be sufficient, but substantially more would likely have made all of the dimensions and estimates more stable. Because a large- scale survey was anticipated for South Africa (indeed, is ongoing as this document is written), the research team elected to add to the 62 items an additional 10 – those with the highest factor loadings in any analysis that had not already been incorporated into the 62. As noted earlier, the major validity study will assess a total of 2,350 randomly selected individuals and a “booster sample” of 1,000 additional individuals selected for their ongoing business activities. We expect that analyses of those 3,350 responses will reveal dimensions that can be used going forward to identify the essential ingredients of an entrepreneurial mindset.

### Implications

We conclude by noting that this research differs in several important respects from past attempts to assess the entrepreneurial mindset. First and foremost, we did not begin with preconceived ideas about what dimensions we should include. Entrepreneurs are routinely characterized – in both the professional literature and the popular press – as desiring autonomy and control, wanting to achieve, creatively seeking solutions to problems, and being willing to take acceptable risks along the way. But measures based largely on these characteristics alone will almost necessarily overlook dispositions, motivations, and behaviors that could prove to be critical. Similarly, measures based on particular theoretical ideas, such as the tripartite conception of an attitude or the Theory of Planned Behavior, can delve deeply into a few sources of entrepreneurial motivation, but cannot “cover the waterfront.” Consequently, we began with a thorough review of the literature, one that as Commarmond (2017) pointed out, involved 76 different characteristics. True, many of these 76 differed only in their specific wording, not at the conceptual level. “Achievement orientation” is not fundamentally different from “Need for Achievement.” Indeed, “Learning from Criticism” may not be fundamentally different from “Open to Feedback.” But the way to create a *comprehensive* measure of entrepreneurial mindset is to begin by casting the widest conceptual net possible, narrow the result by eliminating duplication and overlap, then use statistical methods to establish dimensions that balance breadth against precision. We sincerely hope that our work will lead “toward a comprehensive measure of the entrepreneurial mindset.”

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