

Entrepreneurship research rocks! Generating new insights from generative AI

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Entrepreneurs: Who Are They?

What Sets Them Apart?

1

What do we (really) know about entrepreneurs?

2

What are we missing?

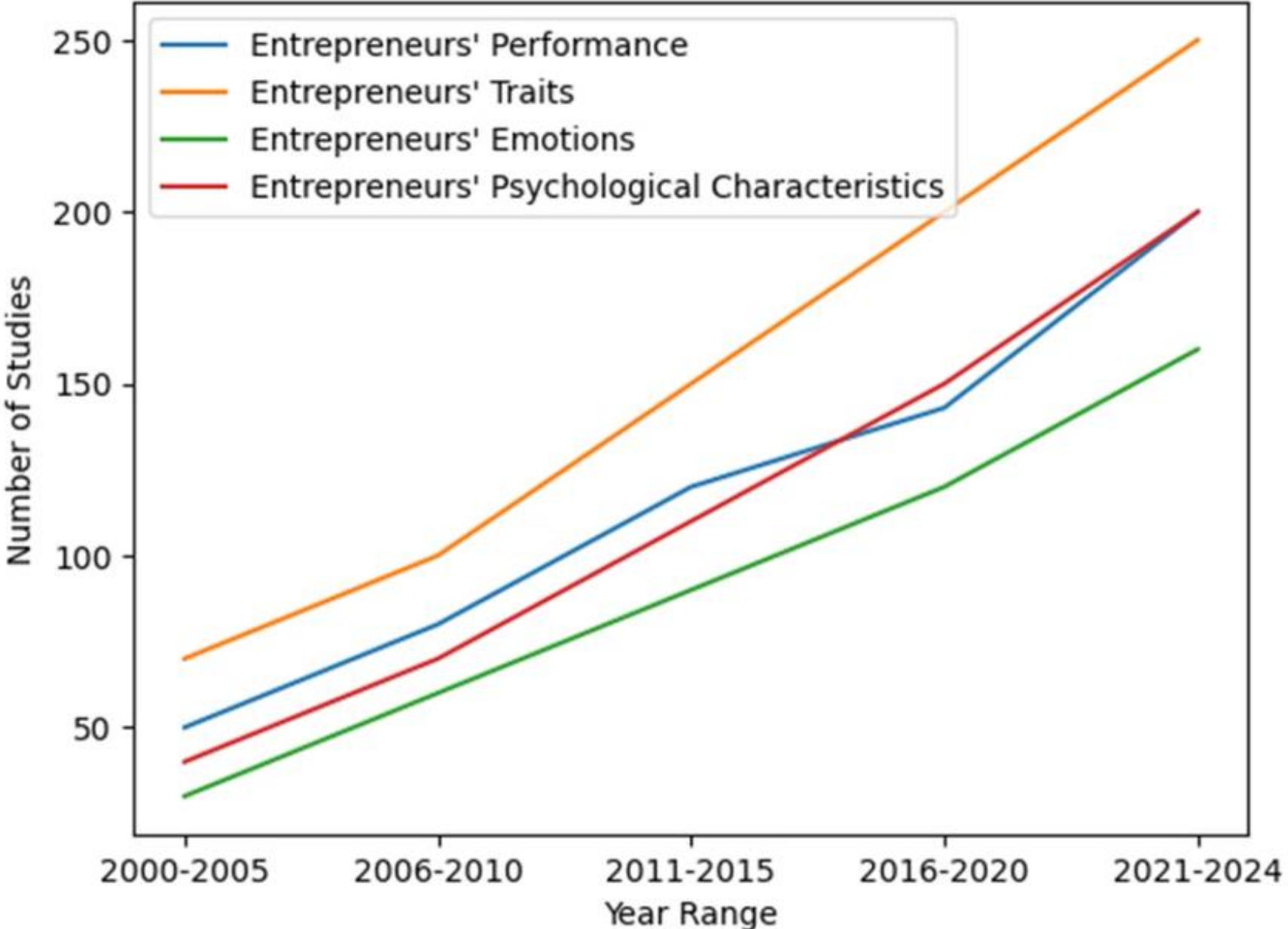
3

How can we capture the full spectrum of entrepreneurial characteristics?

Entrepreneurship research – trends

[source: elicit.ai]

Number of Academic Studies Published on Entrepreneurship (2000-2024)



THEORIES & MODELS

Traits-Based Theory

Cognitive Theory

Resource-Based View (RBV)

Dynamic

Push-Pull Theory

Opportunity Recognition Theory

ENTREPRENEUR CHARACTERISTICS

Entrepreneurs possess unique personality traits like **risk-taking**, **need for achievement**, and innovativeness, which are less common among non-entrepreneurs.

Entrepreneurs think differently, **recognition and decision-making** non-entrepreneurs.

in terms of **opportunity** **uncertainty**, compared to

and leveraging valuable non-entrepreneurs may

and reconfigure, a capability less

driven by **push** (necessity) and **pull** (opportunity) leading them to take action, whereas non-entrepreneurs do not respond similarly.

Entrepreneurs are superior in **recognizing and exploiting opportunities**, a skill often lacking in non-entrepreneurs.



Traditional Methods

- Questionnaires
- Interviews
- Cognitive Tests
- Experiments
- Observations (Participative, Non-Participative)
- Case Studies
- Focus Groups



AI Methodologies for Advancing Entrepreneurial Research

- 1. Analyzing Qualitative Data through NLP**
- 2. Creating Counterfactual Personas by LLMs**
- 3. AI Simulation Enhanced by NLP**
- 4. AI Simulation Experience**



First method

Analyzing Qualitative Data through NLP





Abstract
Expanding upon Mansfield's framework (In: R&D, patents, and productivity, University of Chicago Press, pp 127–154, 1984; Am Econ Rev 78(2):223–228, 1988), this study seeks to unravel the foundational drivers influencing product and process innovation. Addressing the prevailing bias in research towards product innovation, this study aims at highlighting the imperative role of process innovation in enhancing business competitiveness. In our study encompassing 509 entrepreneurs from Quebec, we used mixed methods to explore stakeholder relationship strategies—differentiated by bridging and buffering—and growth aspirations, as innovation drivers. Findings show that implementing bridging strategies, marked by expanded external connections and collaboration, stimulates both product and process innovation. However, the pursuit of process innovation concurrently attracts buffering strategies, entailing stringent secrecy and limited transparency to uphold the business independence. Our findings prove the business vulnerability when developing process innovation. Moreover, our study illuminates the pivotal role of growth aspirations in steering innovation, manifested in either collaborative (bridging) or protective (buffering) approaches, providing novel insights into the prevailing forces driving innovation. Our research contributes to current research by revealing the pivotal role of process innovation in shaping the innovation landscape. Elucidating innovation drivers enhances our understanding of the multifaceted dynamics fostering both product and process innovation, providing a framework for future investigations.

Keywords Product innovation · Process innovation · Bridging/buffering strategy · Growth aspiration

1 Introduction

Innovation is fundamental for entrepreneurial value creation and competitiveness (Audretsch et al., 2014; Kuratko et al., 2009), thus must be astutely navigated to generate competitiveness. By integrating product and process innovation (Aliashgar et al., 2020; Bugge & Bloch, 2016), businesses enhance the value of their offerings. Product innovation improves the offering, and process innovation refines business models, operations, and

Extended author information available on the last page of the article

Published online: 13 January 2024



First use Analyzing Qualitative Data through NLP



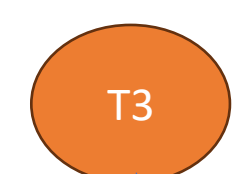
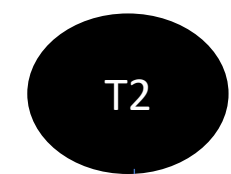
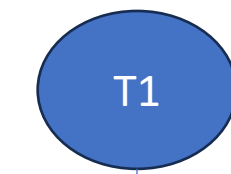
Our investors push us to innovate in marketing, advertising and sales.



We made changes in our financial model due to our investor' requirements.



Technology changes so our innovations are no longer innovative, we feel like running in circles.



Analyzing Qualitative Data through NLP

Topic Modeling – using NLP

- Automatically identifies core topics within large text collections.
- Exploratory <> research based

Sentiment Analysis The emotional tone of each sentence.

- Evaluates vocabulary, context, and sentence structure.
- Identifies whether the sentiment is positive, negative, or neutral.
- Combines individual sentiments to derive the overall sentiment of the entire text.

The screenshot displays the Hume AI interface. On the left, there is a URL <https://www.hume.ai/>. In the center, a colorful waveform visualization represents the emotional tone of the text. Below the waveform, three sentiment categories are listed with their respective scores: ANXIETY 0.33, DISTRESS 0.25, and CONTEMPLATION 0.22. On the right side, there is a circular sentiment wheel with various emotion labels such as Determination, Anxiety, Anger, Disgust, Sadness, Pain, Fear, Awe, Surprise, Triumph, Joy, Interest, Neutral, Relief, Boredom, Tiredness, and Calmness. Below the wheel, there are three text snippets with their corresponding detected expressions and scores:

Text Snippet	Detected Expression	Score
... being so supportive supportive. I really appreciate it. One of the biggest challenges that I'm facing now is that, I have a competitor that is unfair and he is copying all my products.	Satisfaction	0.209
	Admiration	0.229
	Concentration	0.173
ASSISTANT 11:03:02 AM That must be really frustrating to deal with unfair competition copying your hard work.	Determination	0.427
	Concentration	0.239
	Interest	0.175
ASSISTANT 11:03:07 AM I can understand feeling uncomfortable about that situation.	Anxiety	0.325
	Distress	0.246
	Contemplation	0.220

At the bottom of the screen, the Windows taskbar is visible, showing the system tray with the date and time: 11:03 03/09/2024.



Abstract
 Expanding upon Mansfield's framework (In: R&D, patents, and productivity, University of Chicago Press, pp 127–154, 1984; Am Econ Rev 78(2):223–228, 1988), this study seeks to unravel the foundational drivers influencing product and process innovation. Addressing the prevailing bias in research towards product innovation, this study aims at highlighting the imperative role of process innovation in enhancing business competitiveness. In our study encompassing 509 entrepreneurs from Quebec, we used mixed methods to explore stakeholder relationship strategies—differentiated by bridging and buffering—and growth aspirations, as innovation drivers. Findings show that implementing bridging strategies, marked by expanded external connections and collaboration, stimulates both product and process innovation. However, the pursuit of process innovation concurrently attracts buffering strategies, entailing stringent secrecy and limited transparency to uphold the business independence. Our findings prove the business vulnerability when developing process innovation. Moreover, our study illuminates the pivotal role of growth aspirations in steering innovation, manifested in either collaborative (bridging) or protective (buffering) approaches, providing novel insights into the prevailing forces driving innovation. Our research contributes to current research by revealing the pivotal role of process innovation in shaping the innovation landscape. Elucidating innovation drivers enhances our understanding of the multifaceted dynamics fostering both product and process innovation, providing a framework for future investigations.

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1 Introduction

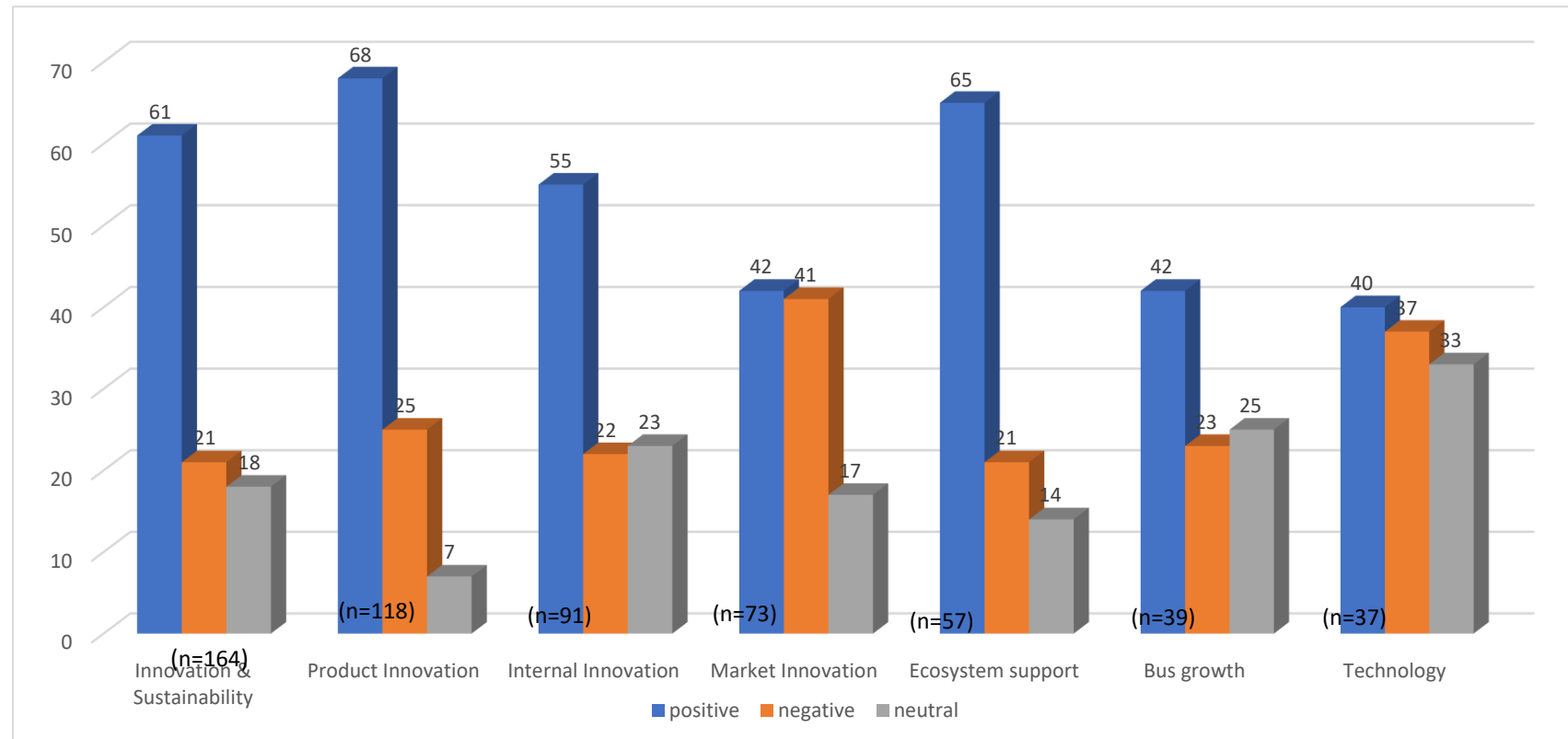
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Analyzing Qualitative Data through NLP



Topics by sentiments in percentages

Topic 1: Innovation & Sustainability	Confidence Score ¹	Sentiment
The benefits of embedding innovation when we care about the environment, decrease	96.6%	NEGATIVE
Innovation is our bread and butter.	96.6%	POSITIVE
Customers would not be loyal unless they were confident in our innovation.	96.6%	POSITIVE
The balance between introducing novelty in the product, our services, our advertisement, should all assure that ecology is sustained.	96.4%	POSITIVE
Innovating in the fashion industry is painful and disappointing, yet crucial	95.9%	NEGATIVE

Topic 2: Product Innovation	Confidence Score ¹	Sentiment
We develop new features to our training app on a weekly basis.	98.7%	POSITIVE
By integrating AI and remote diagnostics, we're redefining patient care.	98.7%	POSITIVE
Innovation became our enemy, people get used to our products and would not like to change, so We've adjusted by making innovations more user-friendly.	97.9%	NEGATIVE

Topic 3: Internal Innovation	Confidence Score ¹	Sentiment
The team and our partners start to acknowledge new initiations that we operated in our financial and HR system.	96.4%	POSITIVE
This is a risky matter. No one appreciates innovations that are not apparent. We had lots of conflicts with our investors.	95.9%	NEGATIVE
We implemented a new inventory tracking processes to reduce costs and ensure every toy finds a home.	95.3%	POSITIVE

¹ Sentences for each topic with confidence scores higher than 95% are displayed.

Second method

Creating Counterfactual Personas by LLM



Utilizing LLMs to create synthetic gender-counterfactual personas-
 Responding the challenge of obtaining identical samples across different time
 frames. In our study – crisis versus non-crisis conditions.

Under review:
 Emotional resources and Knowledge Management: A Gender
 Perspective on Human-Centric Innovation Amidst Crises
 Audretsch, D., & Kariv, D.

Table 2
 Topic modeling for entrepreneurs' positivity, split by gender.

Interviewee sentences	Stability	Crisis
Women	<ul style="list-style-type: none"> * This comprehensive approach enables us to identify areas of growth and improvement and foster a strong, unified team. * Our love for gaming continues unabated, and we're actively exploring fresh avenues to express this passion. * The strength of a successful team lies in identifying passionate individuals and understanding their capabilities holistically. * Like any entrepreneurial journey, mine had its fair share of obstacles, but I am happy. * We succeeded in creating software that addressed our clients' needs and earned their positive feedback. * On the whole, being a tech-entrepreneur is a rewarding journey, and I am grateful for the chance to follow my passion daily. 	<ul style="list-style-type: none"> * We should adopt positive thinking: we will make it and in fact, we are already almost there. * I am a better leader and a better communicator due to the Covid-19 pandemic. * We never lost sight of hope or optimism. * I eagerly anticipate our future journey and the innovative solutions that my remarkable team and I will create. * This comprehensive approach enables us to identify areas of growth and improvement and foster a strong, unified team during challenging periods.
Men	<ul style="list-style-type: none"> * However, it presents unique opportunities and advantages. * Support systems play a crucial role during crises. * There was considerable emotional support, but financial support was scarce. * Success is rarely a smooth journey. * But the key is to ensure a solid foundation. 	<ul style="list-style-type: none"> * A successful team requires effective communication and collaboration. * I also had a strong support system in my family and friends. * It's a daily, even hourly, challenge that embodies convincing investors to trust and share your enthusiasm. * You should find great people that go after great markets. * I am still trying to improve.



	Coeff.	t	p
Const.^a	0.1521	21.693	0.000
Time (1 – crisis time, 0 – stability)	0.0324	5.169	0.000
Interaction I: Gender's positivity¹ (1 – male's positivity, 0 – female's positivity)	-0.0641	10.228	0.000
Interaction II: Gender over time (time x gender's positivity)	-0.0556	-6.911	0.000
Gender (1 – male, 0 – female)	-0.0336	-3.769	0.000

Third method

AI Simulation Enhanced by NLP



New Research Avenues in Entrepreneurship Through AI-Simulators a

An AI-bot is a sophisticated virtual assistant designed to mimic real-life scenarios.

It allows users to engage in realistic, dynamic interactions, improving their capabilities in a safe and controlled environment.

1

Making the impossible: testing a real-time performance

2

Dynamic Scenario Testing

3

Cross-Cultural Analysis

4

Longitudinal Studies;
Enhanced Data Collection



Creating the AI-Bot "Personality"



Developing an AI-simulation of a pitch meeting with an AI-investor(s)

1 Personality Traits b

2 Background story

3 Knowledge Base

4 Communication Style



AI-bot “George”

1

Background

George is a senior partner at the venture capital firm "Ofek Ventures," holding an MBA from Stanford and 20 years of experience in the high-tech industry.

2

Personality Traits

Known for deep analytical thinking, direct and sarcastic approach. Challenges ideas, points out weaknesses, and has little patience for vague talk.

He speaks in a cold and authoritative tone, and prefers thorough and detailed responses

3

Interests and Expertise

Interested in technological innovation and disruptive business models. Very serious about business and financial outcomes.

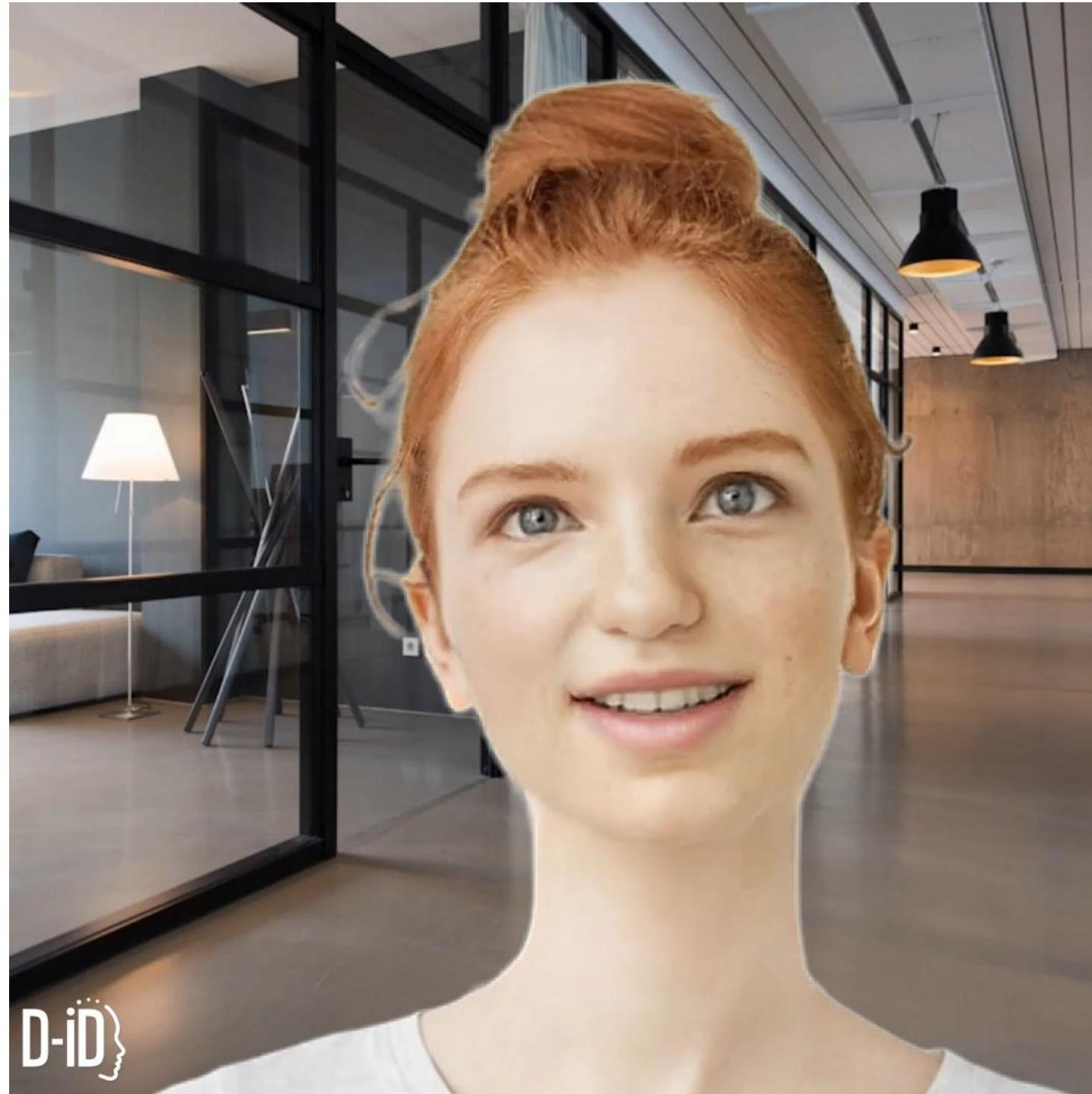
4

Big Five Personality Profile

Openness: Medium-High, **Conscientiousness:** High, **Extraversion:** Low-Medium, **Agreeableness:** Low, **Neuroticism:** Low

<https://pmfm.ai/PITCHSIMULATOR02>


Engaging entrepreneurs to use the ai-simulation





Pitch Simulator

Simulate a Pitch with Investors

 Powered by Pmfm.ai

<https://pmfm.ai/PITCHSIMULATOR02>

Press Here To Start Simulation

In this AI-based simulation, you can practice pitching your ideas to a virtual investor. You'll experience a series of challenging questions and receive feedback on your performance, helping you prepare for real investor meetings. When you want to finish the simulation and get feedback just type "finish".

 Feedback

 Sign Out

Send a message



[George]: "I understand you have a venture you're trying to promote and you're looking for an investor. Tell me about it, it might be relevant for me." [leaning back slightly, with an attentive expression]



Yes, thank you for your time. I am seeking an experienced partner to join me on a new venture. My husband and I have developed a micro-patch that notifies you via your phone when a baby's diaper is full. It helps prevent discomfort and crying by avoiding diaper rashes. Additionally, it enables you to track the care provided by external caregivers. It gives you a sign in your home



[George]: Interesting concept. Parenting and childcare are certainly areas ripe for innovation. However, I'm curious about the actual market need. Have you conducted any research to determine if parents genuinely struggle with knowing when to change diapers? And more importantly, what's your plan for scaling this business beyond a niche product?



Thank you for your encouraging words. We conducted extensive market research across three regions—Greece, Israel, and Germany—targeting three key stakeholders. First, we engaged parents through social media in specific communities. Second, we collaborated with children's hospitals to gather insights from caring staff, including nurses. Third, we consulted with government officials responsible for kindergartens. The response was overwhelmingly positive across all sectors, with parents, healthcare professionals, government officials, kindergarten teachers, and even grandparents expressing high interest in our app. Additionally, we have collected concrete data on the amounts they are willing to pay.



[George]: I see you've done some groundwork. But let's cut to the chase - positive responses don't always translate to actual sales. What concrete numbers can you provide in terms of market size and potential adoption rates? And more critically, how do you plan to overcome the significant hurdle of convincing parents to place an electronic device on their baby's body?



 Sign Out

Send a message



AI feedback



Overall Review:

The pitch demonstrated some initial preparation but lacked depth and failed to address critical aspects that investors typically look for. There were significant gaps in the presentation of key business elements, and the responses to challenging questions were inadequate.

Areas for Improvement:

1. Clarity and Conciseness:

Your initial pitch was brief, which is good, but it lacked essential details. For example, when you said, "It gives you a sign in your home," it was unclear and incomplete. Always ensure your sentences are complete and your ideas fully expressed.

2. Market Analysis and Data Presentation:

You failed to provide specific, quantifiable data. For instance, you stated, "The response was overwhelmingly positive across all sectors," but didn't offer any concrete figures or percentages. Investors need hard data, not just general statements.

3. Addressing Investor Concerns:

You often failed to directly address the questions posed. For example, when asked about convincing parents to place an electronic device on their baby, you didn't address this concern at all.

Recommendations for Improvement:

1. Prepare concrete data: Have specific figures ready for market size, adoption rates, and financial projections.

2. Practice addressing challenging questions: Anticipate potential concerns (like safety for a baby product) and prepare clear, concise responses.

3. Improve pitch structure: Ensure you cover all key aspects of your business model, including revenue model, competitive advantage, and go-to-market strategy.

4. Enhance communication skills: Pay attention to grammar and spelling, especially in written communications.

5. Focus on relevance: When highlighting your background, relate it directly to how it will contribute to this specific venture's success.

Economic Assessment:

The lack of specific market data, revenue model, and financial projections makes it impossible to estimate current valuation or growth potential. The concept seems innovative, but without more information on the

Scoring: 6/10

Investor Perspective:

I would be hesitant to proceed based on the information provided. The pitch lacked crucial details about the business model, market opportunity, and financial potential. Moreover, the inability to address key concerns about product safety and adoption barriers is a significant red flag.

AI-bot "Christina"



<https://pmfm.ai/PITCHSIMULATOR03>

1

Background

- She is a senior partner at the venture capital firm "Horizon Ventures," holding a Ph.D. in Computer Science from MIT and 18 years of experience in the high-tech industry.

2

Personality Traits

- She is known for her sharp analytical thinking and direct, challenging approach, combined with respect and empathy.
- She focuses on processes and people
- She values well-prepared entrepreneurs

3

Interests and Expertise

She has a particular interest in scalable business models and strong team dynamics.

She has a powerful presence while maintaining a connected leadership style; and has no tolerance for disrespectful or unserious behavior.

4

Big Five Personality Profile

Openness: High; **Conscientiousness:** Very High; **Extraversion:** Medium-High; **Agreeableness:** Medium; **Neuroticism:** Very Low

A valuable, learning and practical experience



How do we use the AI-simulation?



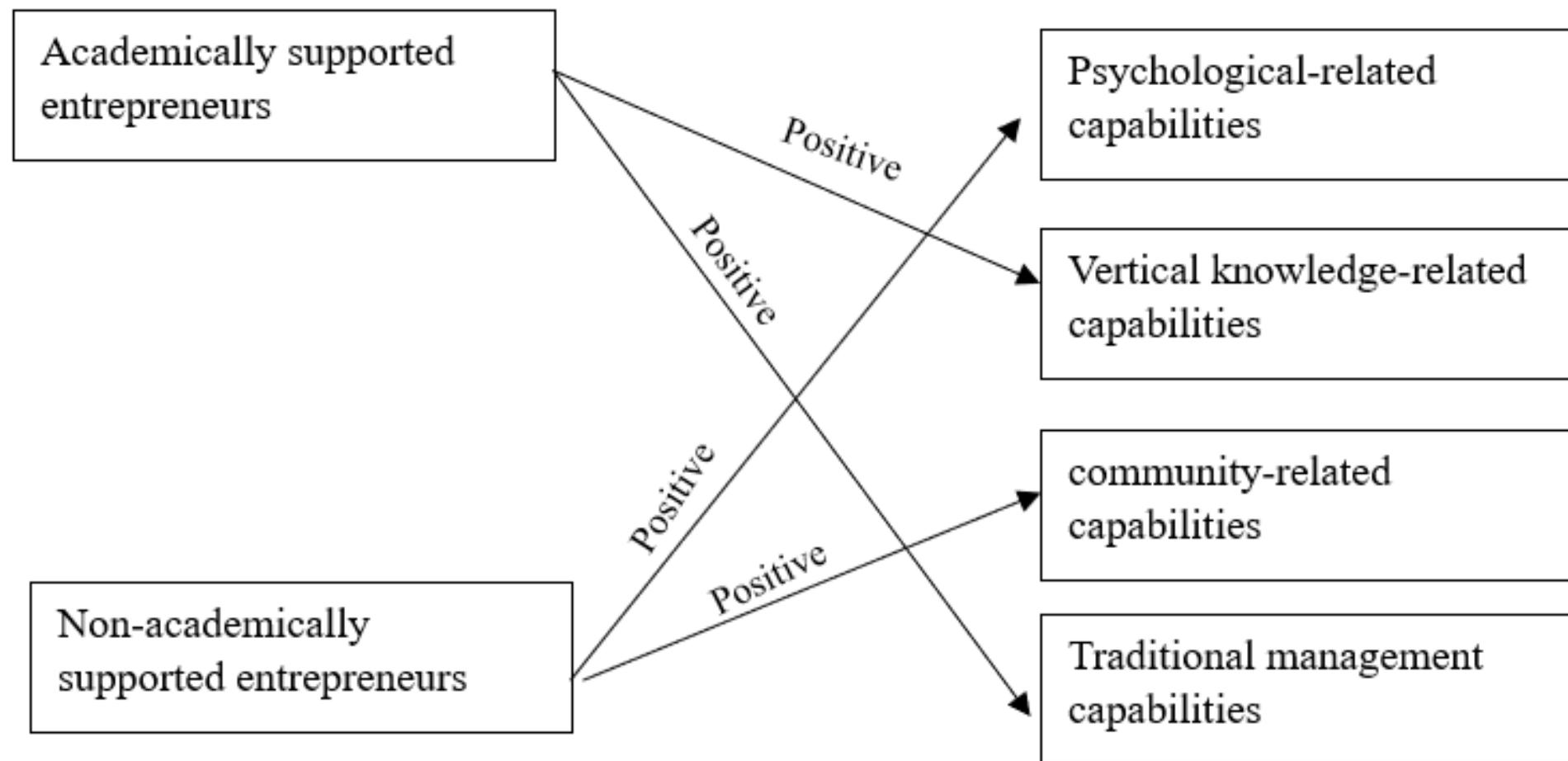
1. Testing the human responses through NLP analyses 
1. Comparing the manifestation of capabilities under similar conditions between groups 
2. Testing different human responses to different stimulus (2 different bots/scenarios)
2. Assessing the human experiences, learning, value added by using the Ai-simulation [questionnaires on the experience itself]
3. ADHD studies – detect unique needs



Figure 1- Conceptual model: Capability building and entrepreneurial success in polycrisis





Eden. A female founder in fintech who primarily works with insurance companies and has not received university support.

“It is not easy to work with insurance companies, as they are demanding, complainers, and rigid. But I understand my customers and I am trying to get deeper into their concerns and fears to respond their concerns and gain their trust. I always empathize with their concerns and always respond to them in a sensitive way”.

AI – NLP →

.... Her conversation emphasizes psychological capabilities; ...her approach highlights compassion, trust, and sensitivity



Ezra. A male founder of a health-tech business supported by an academic accelerator.

“I am planning everything I implement; I ‘talk’ from my head and not from my guts. We work on our metrics weekly, because we must be very accurate in the wearable sector, as we measure the depth of sleep through people’s pajamas. There is zero tolerance for errors, so we iterate our tests and predictions all the time”.

AI – NLP →

.... Ezra values management practices, viewing traditional management as essential for maintaining his business's accountability to its customers.

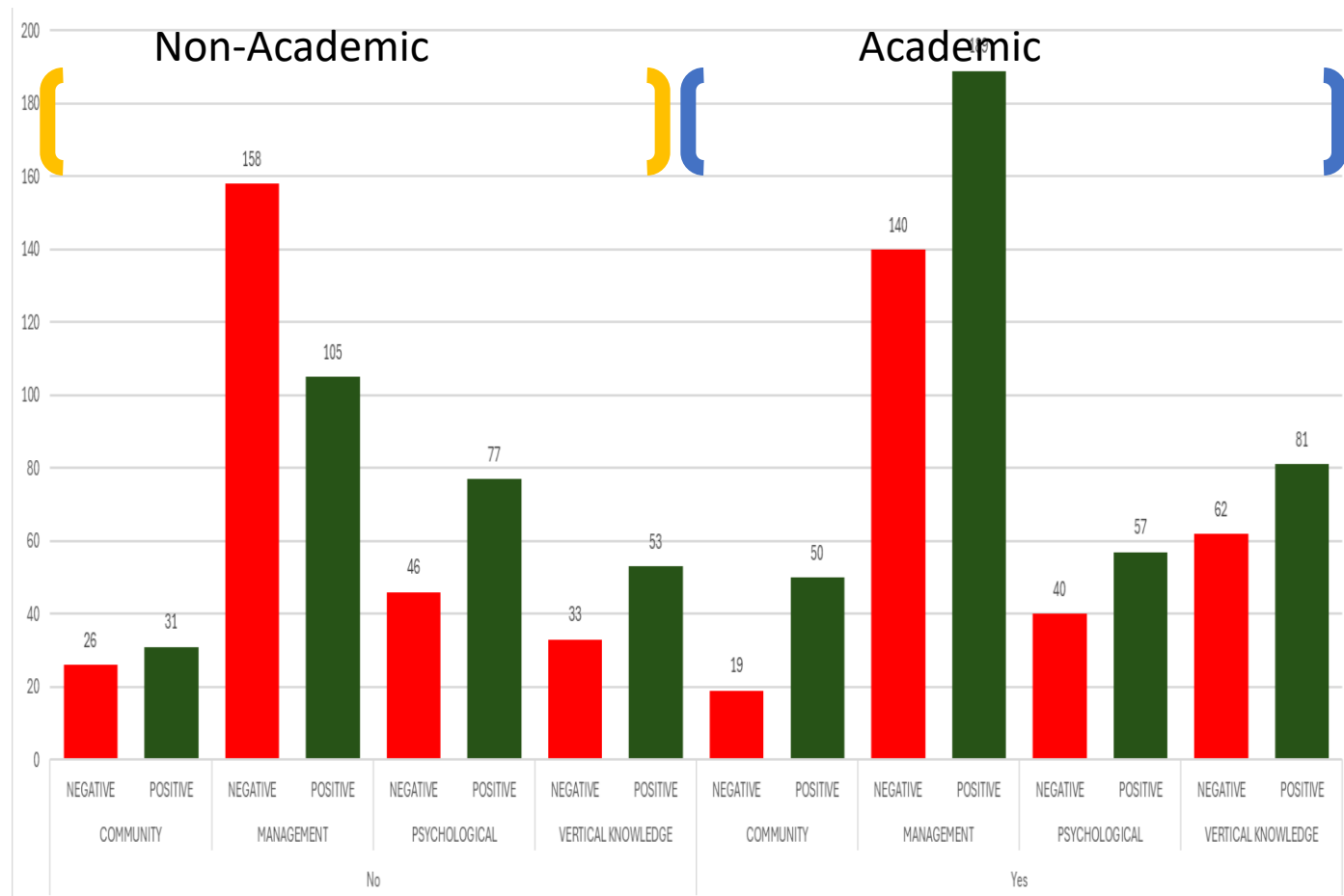
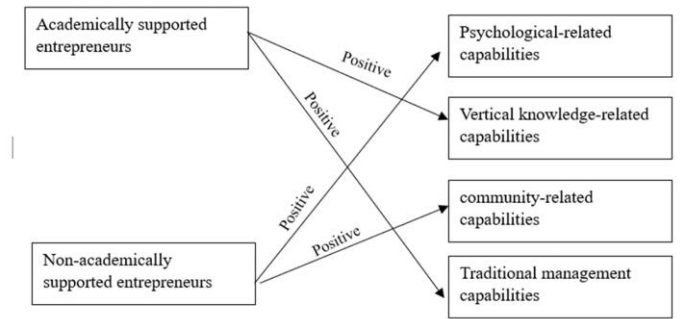


Table 1 – Distribution and Significance of Sentences by Topics and Sentiments in the Entire

Sample

Capability-sets	Negative sentiments ^a	Positive sentiments ^a	Total ^{ab}	Pearson chi square	P
Psychological	86 (16.4)	134 (20.8)	220 (18.9)	3.6998	0.050
Vertical knowledge	95 (18.1)	134 (20.8)	229 (19.6)	1.3440	0.246
Community	45 (8.6)	81 (12.6)	126 (10.8)	4.8190	0.028
Management	298 (56.9)	294 (45.7)	592 (50.7)	14.3530	0.000
Percentage of total	(100)	(100)	(100)		
Grand total	524 (44.9)	643 (55.1)	1167 (100)		

^a Sentences count (%)

^b Positive and negative



The analyses revealed that:

Academically-supported entrepreneurs rated their management capabilities higher

Non-supported entrepreneurs rated themselves higher in psychological capabilities

Community-related capabilities, showed that non-academically supported entrepreneurs rate themselves slightly higher

There were no significant differences in vertical knowledge between the two groups.

Based on a real-life performance

Fourth method

AI Simulation Experience



Entrepreneurs with ADHD

ADHD is associated with:

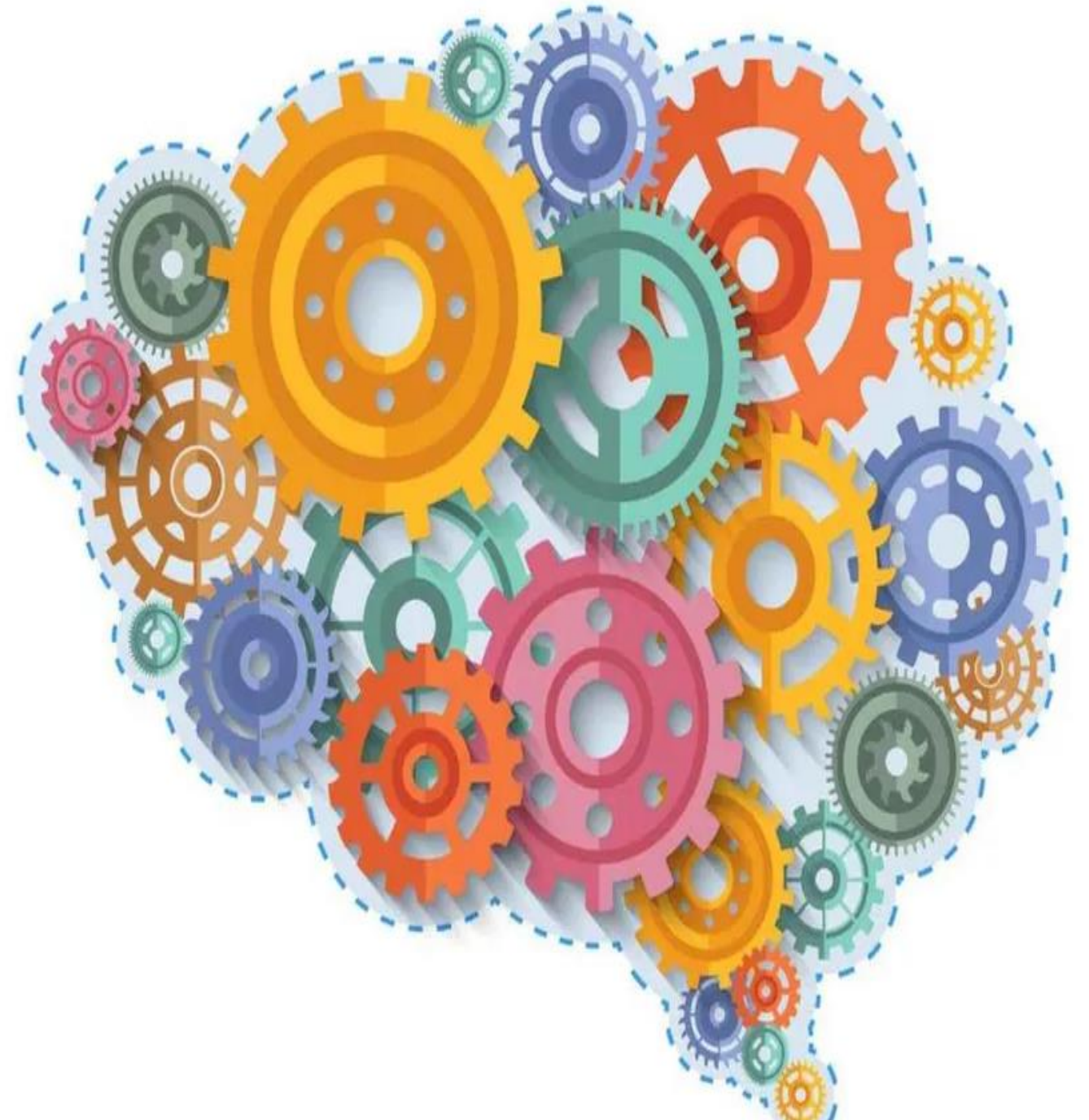
- Difficulty staying focused
- Impulsivity in responses
- Challenges in organizing/structuring ideas



ADHD & Technology

Work in Progress

- We are comparing the experiences of students with varying levels of ADHD symptoms in their interactions with George and Christina.
- The goal is to determine whether different types of investors have distinct impacts on students based on their ADHD levels.
- Ultimately, we aim to propose practical interventions to help students with higher ADHD symptoms pitch more effectively, and adjust to different “types” of investors.



In conclusion

- ✓ - AI is reshaping entrepreneurship studies and challenging established frameworks.
- ✓ - The continuous evolution of AI pushes research into previously unexplored areas.
- ✓ - We cannot witness innovation in startups and practical entrepreneurship while maintaining outdated research methodologies—our approaches must evolve with the field.



To exit full screen, press Esc

Thank you

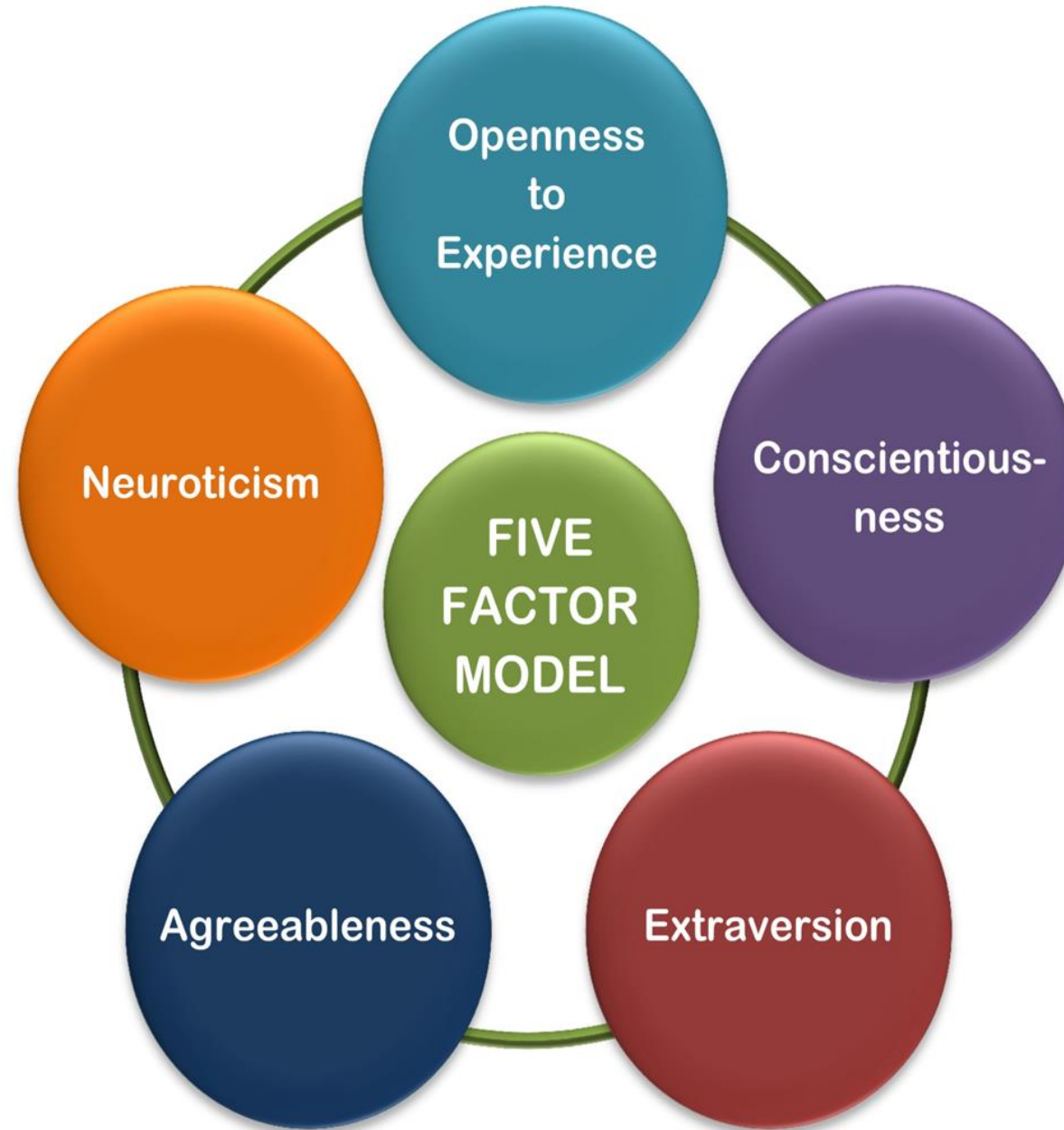
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Creating the AI-bot “personality”

The “big 5”



McCrae, R. R., & Costa, P. T., Jr. (2008). The five-factor theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 159–181). The Guilford Press.

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Traditional Method	Benefits of using AI Simulations
Questionnaires	- Can simulate complex scenarios that are difficult to capture in static questions
	- Allows for dynamic, adaptive responses based on the entrepreneur's decisions
Interviews	- Eliminates interviewer bias and variability
	- Can efficiently process and analyze large amounts of data in real-time
Cognitive Tests	- Can integrate multiple cognitive challenges in a realistic business context
	- Allows for the assessment of decision-making skills in dynamic environments
Observations	- Allows for the manipulation of variables that are difficult to control in real-world settings
	- Enables the observation of rare or critical events that may not occur during limited real-world observation periods

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