Prompt #1:

Statement describing reasons for interest in the Ph.D. Innovation Program, why the program is relevant to your long-term career goals and an example demonstrating creativity in arriving at a solution.

The Dartmouth Ph.D. Innovation Program is my first choice because it would allow me to pursue both academic research and a future entrepreneurship venture as complementary objectives. I would graduate with significant research experience and the skills to grow an impactful company. I am passionate about making progress on issues in education, sustainability, wellness, social justice, and accessibility. Being able to bridge the gap between academia and industry is an essential part of that process. Uniquely, the Innovation Program would not only prepare me for research, but would arm me with the skills to translate solutions from a research sandbox to the broader community

Since I arrived at Stanford, I have focused on the intersection of academia and industry. I sought out entrepreneurship related ventures as a student. As a coordinator for the Business Association of Stanford Entrepreneurial Students (BASES), I organized the BASES E-Challenge Startup Competition, which awards $150,000 in prize funding. For my senior project, I was sponsored by VMWare to do research on improving the efficiency and fairness of their corporate meetings. Through these experiences, as well working as a software engineer at Google, PayPal, and Lark Health, I've developed a sense of what it takes for a research project to succeed, and to scale, in the marketplace.

Beyond the projects that I mention in my Dartmouth Application Essay, I am interested in developing accessible technology. I am an active member of AbilityHacks, a Bay Area centered community of people with disabilities and volunteers building solutions to disability-related challenges. When AbilityHacks took over Carnegie Mellon's NavCog research group, I took responsibility for leading the project's user research and engineering work. Our goal is to develop a navigational cognitive assistant for people who are visually impaired. As I will show, I have melded my teaching and research interests with my involvement in AbilityHacks.

After completing my Masters, my desire to work at a startup led me to Lark. As a representative of Lark, I started mentoring students in the Stanford course CS+Social Good in the winter and spring quarters of 2020. It was a rewarding experience to be a corporate sponsor for a student research class. With access to Lark's internal engineering resources and user base for testing, I was able to guide and accelerate my students' health related projects. I pursued the Lark sponsorship because I love teaching, and ultimately the relationship benefited Lark as well: it gave us exposure to a community of potential new hires and helped our product team test dark horse ideas via the student groups. The experience reinforced in my mind the value of collaboration between academia and industry.

Excited by this success, I organized another partnership, this time between CS+Social Good and AbilityHacks. This winter and spring quarter I will be mentoring student teams on the NavCog project. I've spent the last few months laying the groundwork for the students' research projects, compiling resources and reaching out, and onboarding prospective users for their yet-to-be-determined studies. I'm excited to see where this collaboration leads.

For the remainder of this statement, I am excited to discuss my approach to solving problems at Lark. Specifically, I'll give the example of the ways in which I recently optimized our company's mobile development to meet a critical deadline. I'll end by showcasing one solution in particular, my domain specific language for generating Lark's native UI, that I believe goes beyond industry standards and demonstrates creativity in engineering.

Just over a year ago, our small (about twenty person) engineering team encountered a daunting set of challenges that could determine the success of our company. On multiple new deals, Lark was promising to deliver an "infinitely scalable AI nurse solution" with performance requirements and new features that would all be extremely challenging to deliver given our production codebase. To accommodate a roughly 100x increase in our active user base, and to support a spread of new features, our engineering team decided to refactor nearly the entirety of our frontend and backend.

I served as a liaison between the mobile team, our product team, and our backend teams. I optimised for ways to avoid duplicating effort and improve cross-team communication and alignment, an essential part of meeting our tight timeline. Much of my work boiled down to redoing our iOS and Android codebases in React Native (RN) and enforcing best industry practices, like test-driven development, domain driven design, RN Storybook, and functional programming. I passionately advocated for the move to RN because it meant that we could consolidate our business logic into TypeScript libraries that could be shared with QA and backend. I advocated for the shift to Storybook because it allowed us to 1) sandbox components development for testing purposes; 2) make code sharing easier in the future, for a potential web or VR Lark release; and 3) automatically generate interactive, composable component based, visual product documentation for the entirety of the mobile app. This last point in particular was useful for cross-team communication and alignment.

My most creative decision during the refactor was to implement server driven component specifications for the native UX. My idea was to shift the responsibility for native feature development directly to Lark's non-technical product team, cutting out our mobile team as a middle-man. Once established, this allowed our product team to directly convert their wireframes into specs that would render as interactive, data-rich, iOS and Android UI. This eliminated a testing and communication bottleneck for us and accelerated feature development. Since our RN components are intentionally versatile, they can be composed to satisfy a wide variety of feature demands.

I accomplished this implementation by creating a JSON based domain specific language for specifying Lark specific action handlers and UI on RN components. This level of indirection does add technical overhead to both the frontend and backend. On the frontend, it requires each RN component to be fairly generic, which implicates an additional level of unit testing. On the backend, it requires data fetching, touch action handling, component schema definitions, and feature specification management. I took responsibility for implementing these parts as well and created a microservice using functional programming best practices. My service, "Lark Forms," exposes a straightforward interface building new features. The additional complexity proved to be merited, the Forms service has helped us rapidly roll out new features and meet changing partner demands.

Prompt #2:

> *Statement describing an example of a broad technology development problem that interests you. This should be written in the general form of a proposal for funding and specify one or two potential Thayer School faculty advisors for your proposed work (prior contact with those faculty members by email is recommended)*

It is difficult to overstate the transformational potential that current developments in AI technology present to almost every discipline. As I outline in my Dartmouth application essay, the Ph.D. Innovation Program would allow me to pursue research on storytelling based Artificial Intelligent (AI) interfaces. This is an example of a technology development problem that I find fascinating. I believe that a much deeper understanding of this topic is necessary for creating more human-centered AI user experiences. I am applying for funding from the Innovation Program because, as I show in my accompanying statement, this program is uniquely aligned with my own research and career objectives.

The support of the Innovation Program would allow me explore questions such as: How might we design intelligent educational/wellness chatbots that are perceived as relatable/personalized/trustworthy? How might we leverage narrative to create educational experiences that help learners personally develop, as well as promote, environmentally sustainable practices? How might we design immersive, interactive narratives that seamlessly span multiple mediums (e.g. web, native, robotics, wearables, VR, etc.)? How might we create a narrative based AI educational tutor that adapts to different learning styles and learning needs? And what personal/community/social applications might exist for a storytelling smart assistant?

Beyond my excitement for the Innovation Program, I am particularly interested in doing my Ph.D. at Dartmouth because I know that here I would find the best mentorship. I had a very successful and enjoyable experience working with Dr. Elizabeth Murnane at Stanford and it is because of her I am applying to Dartmouth, and through her that I learned of Dartmouth's Ph.D. Innovation Program.

The mission of Dr. Murnane's Empower Lab, to "develop interactive, data-driven tools that empower people to individually and collectively create, make sense of, and act upon information, with an emphasis on societally impactful applications in health, education, civics, and sustainability," directly overlaps with my interests in HCI, Human-centered design, sustainability, personal informatics, and education. With her mentorship and connections, as well as with the support and funding of the Innovation Program, I would be perfectly positioned to conduct meaningful research.

I could not be more excited about this opportunity.

Dylan Edward Moore

Please see my portfolio for more information on my research: https://www.dylanedwardmoore.com/
Contact email: dylanedwardmoore@gmail.com

References available upon request.

Stanford University

Focus: Human Computer Interaction (HCI)   2012 – 2018
Master's Computer Science, GPA 3.81/4.3
Bachelor's Computer Science, GPA 3.56/4.3

Teaching Assistant   2015 – 2020
- Ten Stanford quarters as a Stanford Teaching Assistant
- Recipient of Stanford's Teaching Honors Award
- Courses taught:
    - Stanford Code in Place: A free online course offered during COVID-19
    - CS181: Computers, Ethics, and Public Policy
    - CS147: Introduction to Human Computer Interaction Design
    - CS221: Graduate Level Introduction to Artificial Intelligence
    - CS109: Probability for Computer Scientists
    - CS106B: Programming Abstraction
    - CS106A: Programming Methodology

Research
- Corporate representative for Stanford's CS + Social Good Course   2020 – 2021
- Worked under Dr. Elizabeth Murnane & Dr. James Landay on interactive creative   2018
  environments for cars
- Interviewed members of Quechua & Waorani tribes & researched sustainable   2017
  ecotourism
- Smart Primer Project: Storytelling-based technology for education under   2017
  Dr. James Landay
- Archaeology Fieldwork in Chavín de Huántar: Helped excavate a 2,500+ year   2013
  old temple
- Stanford Change Labs: Helped design a water catchment system for rural India   2012

Leadership
- Founding member and a leader of the Competitive Running Club   2012 – 2018
- Class President: Elected to plan campus wide events and manage class funds   2015
- BASES E-Challenge Coordinator: Planned a $150k startup competition   2014

Significant Class Projects
- **Senior Project**: An emotionally sensitive, accessible corporate meeting assistant
    - Class Project Award winner, Pejman and Mar (Pear VC) Award winner
- **"Can you take my photo?":** A lightweight guidance system that helps a stranger
  capture the perfect shot, a CS376 class project
- **Finding protests in social media:** Using CNNs to identify protest images on
  Chinese social media that are likely to be censored. A CS224N class project

- **Visuomotor Learning- Object Classification:** A CNN for Amazon's robotic arm pick-and-place task. My team's model can use large amounts of generated data (multiple camera angles, many scenes) and is intended to boost the performance of existing models on the actual task via transfer learning. A CS230 class project
- **A General Game Playing Agent:** A Java prop net GGP player with performance boosts from factoring and latches. My program made it to the semifinals of the end of year class competition. A CS227b class project
- **Pensieve:** An app for sharing memories with loved ones at specific moments. A CS247 class project
- **Rally:** A social network for staying active. A CS147 class project
- **Platform for Creating, Manipulating, and Visualizing Multidimensional Shapes:** My freshman year entry for the 2012 CS106A class Graphics Competition, I was awarded the contest's Grand Prize
- **Connect Four game with AI opponent:** My freshman year entry for the 2013 CS106B class Recursion Competition, I was awarded the contest's Grand Prize

Work Experience

Lark Health Software Engineer, *Mountain View, CA*   2018 – present
- Mobile engineer with full stack and user research responsibilities
- Responsible for moving native codebases to React Native
- Implemented a TypeScript Node.js microservice for generating native UI based on specifications from the server, used functional programming best practices and the fp-ts library
- Integrated Bluetooth and cellular medical devices with native app
- Scripted automations for ticket creation on project management platform
- Involved in product decision making, hiring, user testing, social planning, and mentorship
- Experience with TypeScript, React Native, and Node.js, Python, Java, Android, and Objective-C

TUMO Workshop Leader, *Yerevan, Armenia, Beirut, Lebanon, virtual*   2019 – 2020
- Designed and taught two AI courses on minimax, neural networks, and style transfer
- Designed and taught course on interactive storytelling with chatbots (remotely during COVID)
- Experience in Keras, TensorFlow, TypeScript, and Python

Google Software Engineering Intern, *Mountain View, CA*   2016
- Designed and implemented elements of Ad Extensions with AdWords Team
- Experience in Angular with Dart

Google Software Engineering Intern, *Cambridge, MA*   2015
- Upgraded data pipeline for Google OneBox with Knowledge Graph Team
- Experience in Java and C++

PayPal Software Engineering Intern, *San Jose, CA*   2014
- Designed and implemented metrics dashboard for Core Payments Team
- Experience in JavaScript and Python

Makani Power (now a Google X company) Shop Intern, *Alameda, CA*   2014
- Helped manufacture high altitude wind turbines and self-guided kites
- Used SolidWorks and operated tools in the CAD workshop

Application Essay
Dylan Edward Moore
Dartmouth Thayer School of Engineering, Ph.D. Innovation Program

Talking with Siri reveals two things: Artificially Intelligent (AI) user interfaces can be effective at personalization, but they lack personality. I see storytelling as the missing ingredient. For my doctoral research, I am interested in investigating applications of storytelling in Human-Computer Interaction (HCI). I intend to focus on how AI assistants, robots, mobile interfaces, and smart devices might leverage compelling narratives to solve issues in education, sustainability, wellness, social justice, and accessibility. With a background in both HCI and AI research, as well as industry experience in software engineering and user research, I am perfectly positioned to pursue this intersection of fields through Dartmouth's Ph.D. Innovation Program.

I am fascinated by this opportunity because I am a storyteller. Leaning into that identity has helped me to succeed in my personal life, my teaching, and my academic pursuits. As an Armenian-American child of professional artists, I learned the histories of different artistic mediums, how to communicate complex ideas through narratives, and the significance of a memorable story. Decomposing problems into narratives has helped me navigate challenges in every discipline I enter. For example, in high school, I won Third Place at Intel ISEF for demonstrating how a plucked guitar string could approximate the Vlasov–Maxwell equations in plasma under certain boundary conditions. An infatuation with the creative expressiveness of computer programming is what led me to declare CS when I arrived at Stanford. My experiences abroad in college, through archaeology research in Peru; a study abroad in Berlin, focused on Soviet and Nazi propaganda; and anthropology work in the Amazon Rainforest Basin, where I helped preserve the stories of disappearing Huaorani tribes; expanded my understanding of the role that storytelling has played in different cultures. Drawing on these experiences, I began explicitly focusing on storytelling techniques in HCI research and education.

I first explored applications of storytelling in HCI research as a Masters student. Under Dr. Elizabeth Murnane and Dr. James Landay, I worked on a project in the Stanford Volkswagen Automotive Innovation Lab that investigated how intelligent in-car agents might engage with drivers and passengers. Our goal was to re-envision the weekly work commute as something enjoyable, interactive, and creative. We prototyped audio based, family-centered educational games that connected parents to their children through a playful means.

After Stanford, I joined the startup Lark Health. What drew me to Lark was our mission of a chat-based AI nurse that uses narrative content to engage patients with chronic conditions in a wellness and weight loss journey. Like many other weight loss apps, Lark tracks health and diet through phone sensors, connected smart devices, and user input. However, unlike our competitors, Lark goes beyond counting calories or steps; we aim to be a storyteller with a personality: a cross between a coach and a teacher. That north star, I believe, explains our recent success. Since I joined, I have played a crucial part in designing and building out our product. For a long time, I was one of only two mobile engineers. I helped us navigate difficult product decisions through user research, ultimately gaining valuable insights by driving across Oregon and visiting a sampling of our rural users in their homes. Through countless hours of work, my engineering and user research skills have grown immensely. I am proud of my team and how our

product now helps millions of Americans battle diabetes, hypertension, and depression. In recognition of the amazing work Lark is doing, we just raised a further $70M in funding this summer.

I am passionate about improving access to quality education. From my own teaching, I recognize the opportunity for HCI research to make learning more engaging and creative. In 2019, I spent a month in the Middle East teaching courses on AI topics like search algorithms, neural networks, and style transfer. My course married art, game playing, and math/CS theory. In designing my own content, I drew on nine quarters of past experience as a Stanford Teaching Assistant. When the pandemic hit in 2020, I volunteered to help TA for Code in Place, an "open to anyone" introduction to CS course at Stanford. This strong foundation has focused my desire to pursue AI + HCI research on topics in education.

I applied myself to this problem in August by creating a virtual course for Armenian high-school students that explored using software engineering for immersive storytelling. I based my workshop on Stanford's Smart Primer project, which aims to be a "tablet-based intelligent tutoring system for kids that leverages compelling narratives, intelligent tutoring chatbots, real-world activities, and a child's physical and educational context." My students built interactive chatbots, applying skills we covered related to storytelling theory, AI, and software engineering. What started as a fun educational opportunity for students during a pandemic, and a personal academic interest for me, developed into something more significant when war erupted between Armenia and Azerbaijan. Our class became a safe space during a period of national suffering as violence spilled into my students' lives. My kids turned to building immersive chatbots, mostly about family and friends, to process and share recent traumatic experiences. For me, engaging with those bots was a harrowing and humbling reversal of the student-teacher relationship. This incredibly disturbing turn of events has reinforced my belief that storytelling can imbue an AI interface with compelling human elements.

Dartmouth's Ph.D. Innovation Program uniquely fits my specific interests and would be the ideal way for me to continue pursuing my passions. In particular, I am excited about the opportunity to continue working with and learning from Dr. Elizabeth Murnane. In the long term, I have two career objectives. I hope to pursue entrepreneurship and a professorship. 2020 has been a reminder to me of the growing threats that our society faces; future generations will need to combat a new wave of challenges stemming from climate change, disinformation, and inequality. I want to spend my career focused on tackling important issues like these. With the support of the Innovation Program, I see storytelling based AI technology as a space where I can make a significant impact.