

MEDTECH SPIN-OUTS

Challenges when Addressing Behavioral Concerns

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M.Sc. Eng. Design & Innovation

Technical University of Denmark (DTU)

Master Thesis

February 8th - July 20th 2018

30 ECTS points

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ABSTRACT

Ensuring human health is one of the major challenges facing the global society. Academic research holds major potential within the development of new Medical Technology (MedTech) and can thereby contribute positively to societal health and well-being. One method of translating academic research into useful innovation, is through entrepreneurship, via university spinout companies. However, problems related to human behavior represents one of the primary obstacles to successful MedTech innovation, also within entrepreneurship.

This thesis seeks to explore the challenges spinout companies face when attempting to addressing such behavioral concerns. It first reviews established knowledge on the entrepreneurial process, as well as the process of addressing behavior in product development. Effectuation theory is identified as an appropriate framework for effective entrepreneurship. The current best practice for addressing behavioral concerns, is found in the field of behavioral design. After reviewing existing research within both fields, they are compared, to identify potential conflict between them and their associated processes. Several conflicting demands emerge. In particular, behavioral design appeared to require a more goal-oriented and causal mode of reasoning, than what was typical within effectuation. Furthermore, the effectual process is characterized by a lack of clearly defined, sequenced stages, while the behavioral design process requires just that.

The intersection between the two fields is found to be relatively unexplored by current research. An explorative multiple-case study is therefore determined as an appropriate next step for the thesis. 4 spin-out companies were studied, primarily through in-depth semi-structured interviews with 6 entrepreneurs across those spin-outs. The findings confirm the existence of the potential conflicts identified in the literature review. Furthermore, it is shown that the investigated spin-out entrepreneurs navigated these conflicts by addressing behavioral concerns with an effectual mode of reasoning. This is well aligned with how the entrepreneurs would typically operate, but is found to be inadequate in this setting. It is argued that this approach is in-effective both from the perspective of behavioral design and effectuation.

Finally, 3 underlying obstacles for better parallel behavioral design and effectuation processes, are identified: 1) the spin-out entrepreneurs are unable to recognize relevant means, 2) the spin-out entrepreneurs are unable to understand what data is appropriate and 3) the spin-out entrepreneurs are unable to determine when to shift between effectual and causal reasoning.

These results provide a novel perspective on the intersection between entrepreneurship and behavioral design. They constitute a vastly improved understanding and a better definition of the challenges faced by the selected spin-outs. The findings can be useful as a basis for further studies, to investigate if these are indeed common phenomena among the general population of spinout entrepreneurs. The results also indicate potential strategies to overcome the challenges. Some of these are linked to the spin-outs background in university, suggesting that their spinout roots might be part of the solution.

LEARNING OBJECTIVES

1. Identify and reflect on the issues between effectuation and behavioral design.
2. Understand and reflect on the interaction between the various components in those issues.
3. Apply current engineering background to investigate, understand and reflect upon current international research within effectuation and behavioral design.
4. Apply current research within effectuation and behavioral design to develop ideas and frame the project
5. Apply scientific methodologies, theories and tools to take a holistic view and delimit the comparison of effectual and behavioral design processes set in a broader academic and societal perspective and basis propose a variety of possible action.
6. Communicate and mediate research-based knowledge both orally and in writing
7. Show familiarity with and ability to seek out leading international research within his/her specialist area.
8. Can work independently and reflect on own learning, academic development and specialization
9. Masters technical problem-solving at a high level through project work, and has the capacity to work with and manage all phases of a project – including preparation of timetables, design, and documentation.

ACKNOWLEDGEMENTS

A special thanks to my supervisors Jes Broeng and Philip Cash for valuable supervision and support throughout the work with this thesis. Without your help and guidance, I would not have succeeded with this research project, nor would it have yielded such valuable results.

I would like to extend my gratitude to Open Entrepreneurship for awarding me a scholarship to the Sutardja Center for Entrepreneurship and Technology (SCET) at University of California Berkeley as visiting student research to work on this thesis in the heart of entrepreneurial practice.

In continuation thereof, I would like extend the highest gratitude to Ikhlaq Sidhu, Faculty Director and Founder of SCET, Susan Giesecke, Director of Global Engagement at SCET, and Rick Rasmussen Director of Startup Programs at SCET and course manager at “Startup Semester”, for giving me such a warm welcome and introduction to a host of inspiring experiences and helpful contacts.

Additionally, I am very grateful to the participating MedTech spin-out entrepreneurs for their time and open-hearted sharing, as well as continuous encouragement throughout the development of this thesis.

Finally, a special thanks to my partner-in-crime, Oliver Hvidt, for his support and willingness to move across the world to the San Francisco Bay Area, for the commencement of this thesis.



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THESIS STRUCTURE

This thesis consists of 7 chapters:

Chapter 1 introduces the project and the investigated problem area. The project aim and the research question is presented.

Chapter 2 Reviews the current literature on the problem area. The research framework, which forms the theoretical foundation for this thesis, is explained.

Chapter 3 presents the methodology of the multiple case study conducted as part of this thesis. Introduces the selected cases.

Chapter 4 presents the key findings from the multiple case study related to the research question.

Chapter 5 compares and discusses the findings in relation to the research framework and established knowledge introduced in chapter 2.

Chapter 6 presents the conclusion on the research question, based in the litterature review and the findings from the subsequent case study.

Chapter 7 discusses the implications and limitations of this thesis, and outlines the potential for further work.

Reading Guide

This thesis is meant to be read in sequence from Chapter 1 to Chapter 7. Associated appendices are attached to this thesis for optional review by the reader.

Following chapter 7, a list of references is provided.

TIP: Wide margins for your thoughts

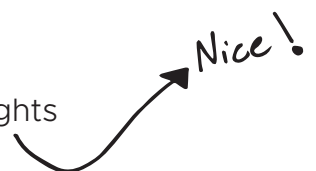


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Nomenclature

Behavioral Design: In this thesis behavioral design is viewed as” a specific type of design where designers seek to develop products and/or systems that influence human behavior through interventions” (Hartlev & Durazo, 2015).

Medical Technology (MedTech): In this thesis MedTech is viewed as: *”The application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of life”* (World Health Organization 2018)

Spin-out companies: Spin-out companies: In this thesis spin-out companies are viewed as: *”The formation of a new firm or organization to exploit the results of university research”*(Klofsten & Jones-Evans 2000)

1 INTRODUCTION

1.1 Project aim & problem statement



In our global society, with changing demographics and an increase in lifestyle diseases across the world, there is a critical need for innovation within healthcare. Innovation is seen as fundamental to ensuring human health and that societies live up to the UN global goal: to “ensure healthy lives and promote well-being for all at all ages”(United Nations 2018).

Technical research holds major potential within the development of new Medical Technology (MedTech) and can thereby contribute positively to societal health and well-being.

Much of this research stems from an academic setting, such as universities. However, there is a challenge in translating the technical findings into innovation that benefit society. This is a well-known issue within technological innovation and is for example at the core of the vision statement of Innovation Fund Denmark (Innovationsfonden); “Entrepreneurship, partnership and an international outlook thrive so that ideas, knowledge and technologies may be translated into viable businesses and innovative solutions for the benefit of society” (Innovation Fund Denmark 2015).

One method of translating technical findings from university into societal innovation, is by entrepreneurial means, for example through university spin-outs. However, university spin-outs face many obstacles when translating scientific and technical discoveries into innovations that benefit society.

One challenge is the behavior of intended users of the MedTech innovation.

Many of the major societal challenges, including healthcare, can be linked to inexpedient human behavior (Branson et al. 2012). For example, adherence to long-term therapy for chronic illnesses in developed countries averages only 50%, with poor health outcomes and increased costs as a result (WHO, 2003). Clearly, the understanding and adapting to human behavior, is central to the potential impact of future MedTech solutions.

For this reason, it is important that the university spin-outs incorporate a process to effectively address behavioral challenges the spin-out faces. This is key, both for capturing the entrepreneurial opportunity associated with their technical discovery, and for fulfilling the potential to benefit human society in accordance with the UN goal.

With the emergence of the field of behavioral design in recent years, the understanding of, and scientific evidence for, processes that effectively deal with behavioral problems and behavior change, have significantly improved. Behavioral design bridges the established understanding of behavioral factors with design practices and introduces an effective process for creating design interventions that effectively addresses behavioral challenges (e.g. Cash et al. 2017; A Selvefors et al. 2011; B. J. Fogg 2009b).

Moreover, new knowledge on the entrepreneurial process and how it is conducted effectively, has been established in recent years. The theory of effectuation, first introduced in 2001, is supported by increasing evidence as a best practice for entrepreneurs. The field of effectuation research has shown that expert entrepreneurs should base the development of their venture on an effectual mode of reasoning, to effectively navigate the high degree of uncertainty they face (Sarasvathy 2001).

On that basis, it is clear that the scientific understanding of both the behavioral design- and entrepreneurial process is much better today than only a few years ago. This gives the individuals engaged in each of these processes a favorable starting point for understanding and solving challenges related to behavior and entrepreneurship.

However, to solve the grand problems highlighted above, the spin-out entrepreneurs must be effective at both of these processes in parallel. Therefore, it is necessary to understand the interdependencies between simultaneous behavioral design and effectuation processes.

This intersection between the two fields is found to be relatively unexplored by current research. Therefore, this thesis aims at exploring the interplay of behavioral design and effectuation, when university spin-outs seek to address behavioral challenges. Therefore, this thesis seeks to answer the following research question.

WHAT CHALLENGES DO MEDTECH UNIVERSITY SPIN-OUTS FACE WHEN ADDRESSING BEHAVIORAL CONCERNS?

Since the thesis deals with a relatively unexplored research area, concerning two fields that are still in rapid development, an explorative research approach is desired. For this reason, the chosen research question is deliberately open and broad. This enables the researcher

to pursue valuable insights that might emerge during the course of the study.

To answer the research question, the thesis first examines current knowledge about behavioral design and effectuation, through a review of established literature of the respective fields. Based on this knowledge, the two frameworks are analyzed in comparison, to identify potential conflicts and areas of interest. The review and analysis identify several conflicting demands and 2 specific potential conflicts.

No current research on how spin-out entrepreneurs navigate those conflicting demands in practice, is found. This indicates a relatively unexplored area in the established literature. To explore the issue further, an explorative multiple case study of university spin-outs working with behavioral concerns is chosen.

The study finds that the 2 potential conflicts identified in the literature review also prevail in the examined spin-outs. The case study additionally reveals more nuances to the identified conflicts. It also identifies a previously unknown challenge related to recognizing effective means for addressing the behavioral concerns.

Finally, the combination of existing research and the conducted case study, enables the thesis' research question to be answered. While there are inherent limits to the transferability of the qualitative data from the case-study, the thesis does provide new relevant knowledge. The findings also point to potential solutions for lowering or mitigating the conflicts between the two processes. Further research could serve to bolster the general applicability of the findings, or further explore potential solutions.

In relation to this thesis, the author was awarded a scholarship as visiting student researcher at University of California Berkeley through the Danish initiative Open Entrepreneurship. This opportunity gave the author a unique connection to the heart of entrepreneurial expertise in Silicon Valley and the San Francisco Bay Area. This environment was profoundly relevant for studying the research topic of this thesis. Hopefully, the benefits for the research outcome are clear upon reading.

2 LITERATURE REVIEW

To begin exploring the research question, it is first necessary to review existing knowledge of what constitutes an effective entrepreneurial process, as well as how to effectively deal with behavioral concerns. This literature review examines existing research in this area, to understand these two processes and their key characteristics.

2.1 Introduction

This literature review examines current literature in the areas of effectuation and behavioral design. The goal is to establish what constitutes an effective entrepreneurial process and an effective process for dealing with behavioral challenges, respectively.

The literature review first turns attention to the entrepreneurial process. It establishes effectuation as an appropriate framework for understanding what constitutes an effective entrepreneurial process in the scope of this thesis. It then proceeds to examining the characteristics of effectuation and an effective effectual process

The literature review subsequently identifies behavioral design as an appropriate framework for understanding the process of dealing with behavioral concerns in an effective manner. After this is established, the features of behavioral design and an effective behavioral design process according to existing research are examined.

After identifying and examining the two relevant frameworks separately, the review proceeds to compare the two fields. The focus of the comparison is to identify potential conflicts, which is at the center of the research question. Two potential conflicts in the intersection of effectuation and behavioral design are identified.

However, it is also concluded that current research has not studied this intersection in detail. This is not surprising, since both effectuation and behavioral design are relatively new fields of research. It indicates that there are fertile grounds for novel studies of the issue, such as this thesis. The final step of the literature review is to establish a research framework, which provides the theoretical foundation for the rest of this thesis.

2.2 The entrepreneurial process: Effectuation

This section establishes effectuation as an appropriate theory for understanding the entrepreneurial process. Afterwards, it examines the characteristics of effectuation and what constitutes an effective process, according to the theory.

2.2.1 Effectuation; a good framework for understanding what is distinct about the entrepreneurial process

Entrepreneurship is an intriguing field. While it is rich in anecdotal data, or “war stories”, from practitioners, it is fragmented and difficult to synthesize one harmonized understanding of the entrepreneurial process across the literature (Moroz & Hindle 2012). However, in recent years the theory of effectuation has emerged as the primary candidate for providing such an understanding (Perry, Chandler & Markova, 2012).

The theory of effectuation originally relies on empirical data from 30 expert entrepreneurs across industries presented in the 2001 article “Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency” by Saras D. Sarasvathy.

The paper basically states that entrepreneurs are distinct from non-entrepreneurs in the way they reason; that entrepreneurs rely more on what Sarasvathy (2001) refer to as effectual reasoning, while non-entrepreneurs rely more on so-called causal reasoning.

According to Perry, Chandler & Markova (2012)’s review of entrepreneurship literature, effectuation “represents a paradigmatic shift in the way we understand entrepreneurship” in that it questions the causation-based models of entrepreneurship that have previously been prevailing. Perry, Chandler & Markova (2012) further propose that effectuation is especially appropriate since it addresses the distinct circumstances under which entrepreneurs must operate. According to the theory, the level of uncertainty faced by the entrepreneurs is so significant, that the future is viewed as inherently unpredictable (Sarasvathy 2001). This sets effectuation apart from much of the previous theory on economics and business strategy, which typically focuses on methods of analysis and prediction. According to effectuation, focusing on predicting future outcomes is simply not feasible in the uncertain world of start-ups. Effectuation instead proposes another, more effective way to deal with these extreme conditions (Sarasvathy 2001), which will be examined in section 2.2.2 and 2.2.3.

Several studies indicate that effectuation is a good framework for understanding successful entrepreneurship.

First, Read, Song & Smit (2009) showed a positive correlation between venture success and the use of effectuation through a meta-study of 9.897 new ventures. Although establishing statistical evidence for the effect of a “way of reasoning” presents challenges in terms of extracting and quantifying the data, which inherently limits the statistical validity of the study, it is at least a strong indication that a

positive correlation exists.

Secondly, Dew, Read, Sarasvathy, & Whitbank (2009) showed that expert entrepreneurs relied more on effectual logic, while novice entrepreneurs relied more on causal logic. While this does not effectively prove that effectual reasoning causes successful entrepreneurship, it does indicate that there's a correlation between effectual logic and successful entrepreneurship.

The second point is also one of the limitations of effectuation; effectuation is a distillation of the "optimum-entrepreneur", which may vary from real (less "optimum") entrepreneurs and entrepreneurial processes. Specifically, for this thesis, one could expect that the individuals involved in the MedTech university spin-outs are likely to be more or less novices. Since novice entrepreneurs would not tend to follow effectual reasoning to a high degree, effectuation cannot always be assumed to be a good model for these cases. However, this does not mean that effectuation is not an appropriate framework for this study. The goal is not to find the model that best describes the specific case studies. It is instead to identify the framework that helps us understand the entrepreneurial process in general and what represents best practice. The case studies can then help us understand why best practice is or isn't being followed – including potential conflicts with behavioral concerns. As such, the process proposed in the framework of effectuation is something the spin-outs should strive towards. Whether they succeed in doing so, will reveal valuable information. Furthermore, the spinouts would arguably tend to do so more and more over time, as experience accumulates. Also, since the spinouts all have strong ties to the world's leading start-up environment in the San Francisco Bay Area (see Chapter 3 for description of cases), it would arguable be unreasonable to assume that they are complete novices.

The fact that effectuation is associated with entrepreneurial expertise, is therefore seen as an advantage in terms of its relevance for this thesis. Since effectuation was first introduced in 2001 by D. Sarasvathy, the field is arguably still in its nascent state with inherent risks. However, the theory of is already considered distinctive in the field (e.g. Perry et al. 2011) and is considered an appropriate framework to understand the distinctive characteristics of entrepreneurship in this thesis.

Existing research finds correlation between effectuation and entrepreneurial success and expertise, as well as an ability within effectuation to address to distinct circumstances of entrepreneurship. Based on this, effectuation is viewed as an appropriate framework for this thesis. The following section examines the approach to entrepreneurship that effectuation entails, in more detail.

2.2.2. The effectual approach - in the face of great uncertainty

As mentioned, one of the key features of effectuation is the views of the future it implies: Effectuation is based in the assumption that the future is inherently unpredictable. Hence, people who utilize effectual reasoning do not attempt to predict the future, as they fundamentally do not believe that they are able to. Instead, people who rely on effectual reasoning will value elements within their immediate control. The underlying logic is that “to the extent we can control the future, we do not need to predict it” (Sarasvathy 2001).

This is in contrast to causal reasoning, where the future is considered predictable, given sufficient data and analysis. The underlying logic in this case, is that “to the extent we can predict the future, we can control it” (Sarasvathy 2001).

The logic of an “predictable future” in causal reasoning, can be extended to the notion that entrepreneurship is essentially about “finding and exploiting” the entrepreneurial opportunity. The entrepreneurial opportunity exists independent of the entrepreneur (Sarasvathy 2001) and can be identified and captured by applying the right analysis and predictions. In contrast, in effectuation, the entrepreneurial opportunity is viewed as interdependent with the entrepreneur. It is co-created by the need, market, customers, as well as the entrepreneur (Sarasvathy 2001).

2.2.2.1 Principles of the effectual approach

Given the distinct view of the future and the creation of the entrepreneurial opportunity, entrepreneurs using effectual reasoning, have a fundamental skepticism of the predictive power of analysis (since the future cannot be predicted). In causal reasoning, predictions provide a basis for decision making, but this is clearly not viable for effectual entrepreneurs. Instead, they assume their effectual mode of reasoning is based in techniques of non-predictive control, or what Sarasvathy (2008) refer to as “the principles of entrepreneurial expertise” or “effectual principles”.

The effectual principles are a key characteristic of the effectual mode of reasoning. Sarasvathy (2008) have identified 5 heuristic principles that the entrepreneurs employ (see next page). These principles are worth examining for this study, as they explain more how the entrepreneurs should be expected to operate on a more specific and practical level. This is relevant for understanding potential conflicts with other processes and modes of decision making.

When utilizing an effectual mode of reasoning, the entrepreneur imagines possible ends using a given set of means, and continuously employ the effectual principles at each step of the process to generate

Principles of Entrepreneurial Expertise (Sarasvathy 2008)

Bird-in-hand – start with means

Named after the saying; a bird in hand is better than 10 in the bush, the bird-in-hand principles explains how entrepreneurs use their available means as a starting point.

- WHO they are; what personal traits and abilities they possess.
- WHAT they know; what constitutes their education, training and personal skills.
- WHOM they know; the people in their network.

Based in their available means, the entrepreneur imagines possibilities they may explore, thus utilizing the one bird they actually have in hand (i.e. actual means), rather than the 10 birds in the bush (i.e. possible, but uncertain, future means).

Affordable loss – focus on downside/risks

The affordable loss principle refers to how entrepreneurs will focus on the potential downside of an opportunity. Entrepreneurs will prefer to limit risks through an understanding of what they can afford to lose rather than how they optimize profit. This approach enables entrepreneurs to not tie themselves to any “theorized or preconceived market or strategic universe”, and instead remain open to multiple potential markets or opportunities and even create their own if necessary, with little or no meaningful losses.

Lemonade – leverage contingencies

The lemonade principle is named after the proverb; when life gives you lemons, make lemonade. It refers to how entrepreneurs exploit, and even welcome, contingencies. Instead of trying to limit surprises, entrepreneurs exploit the contingencies. This makes them especially adapt to thriving in an uncertain environment, where non-entrepreneurs would often struggle, by turning the unexpected into gain by leveraging contingencies.

Crazy quilt – make partnerships

The crazy quilt principle refers to how entrepreneurs value alliances through commitments from self-selecting stakeholders. By having partners commit to the venture, the entrepreneur is able to expand the “means-pool”. However, partners also contribute constraints through new goals and play a vital role in co-creating the entrepreneurial opportunity.

Pilot-in-the-plane – control vs prediction

This principle is the embodiment of the underlying logic of effectuation; that the future is inherently unpredictable. Therefore, rather than focusing on uncertain future outcomes, entrepreneurs focus on activities that are within their control; where they can be “like the pilot on the plane” (Sarasvathy 2015).

new means and (often) imagine new ends. Sarasvathy (2001) refer to this as a means-driven process.

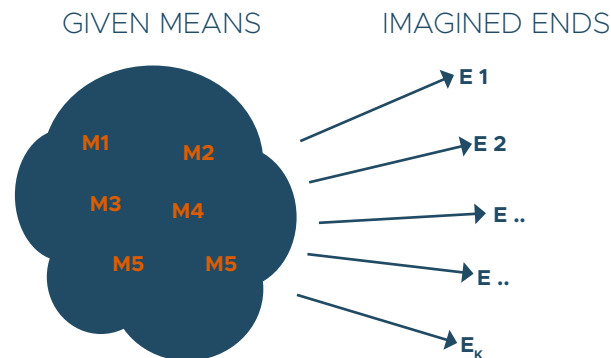


Figure 1 Due to the extreme level of uncertainty facing the entrepreneur, in effective entrepreneur should assume a predominantly effectual mode of reasoning based in a means-driven process. Figure inspired by Sarasvathy (2015)

This process is what gave name to effectuation theory; given a fixed set of means, the entrepreneur imagines possible *effects*. This is opposed to causation, which takes its starting point in a fixed goal (i.e. effect) and examines various ways (i.e. causes) which can lead to that goal. Notably, while effectuation and causation are often juxtaposed for explanatory purposes, Sarasvathy (2001) emphasizes that they are not dichotomous. In fact, *both* are an integral part of human reasoning, meaning that human reasoning will employ both a causal and effectual mode of reasoning, according to Sarasvathy (2001). The use of an effectual mode of reasoning is merely used more frequently by entrepreneurs' due to the distinct characteristics of entrepreneurship, namely the extreme uncertainty.

KEY TAKE-AWAY: IN ORDER TO EFFECTIVELY OPERATE IN THE FACE OF EXTREME UNCERTAINTY, THE ENTREPRENEURS ASSUME AN EFFECTUAL MODE OF REASONING THAT ALLOW FOR A HIGH DEGREE OF NON-PREDICTIVE CONTROL.

2.2.3 The effectual process – progression through commitments

The effectual view of the future as unpredictable, is also key to understanding the entrepreneurial process within the framework. In order to effectively navigate this extreme uncertainty, the entrepreneur must remain “nimble”, to be able to adapt to the inevitable contingencies and consistently follow the effectual principles.

Read and Sarasvathy (2005) suggest that at its core, the entrepreneurial process is “a collection of decision tasks such as selecting an idea or opportunity to begin with, creating a legal entity, garnering resources,

bringing stakeholders on board, managing growth and exit strategies, and so on". Hence, becoming an effective entrepreneur evolves around mastering these elements, and the associated decisions and actions that constitutes those elements (Read & Sarasvathy 2005).

As established in the previous section, in the effectual view, the effective way of "mastering these elements" is based in the means available to the entrepreneur, and one of the key characteristics of effectuation is that it is means-driven (Sarasvathy 2001). This means that the effectual process originates with who the entrepreneurs are, what they know and whom they know, as well as what they can do with those means (Sarasvathy & Dew 2005).

According to effectuation, one of the important things the entrepreneurs can do, is to reach out to people they know (or meet) and negotiate commitments. Hence, it is central to effectuation that new commitments to the venture are not determined by a real or perceived "opportunity", but rather the immediate means of the entrepreneur (whom the entrepreneur know) and contingencies (whom the entrepreneur meets), and what these potential stakeholders are willing to commit. Ultimately, those commitments determine the "opportunity" that will be the foundation for the entrepreneurial venture (Sarasvathy & Dew 2005).

Therefore, a central aspect to the progression of the effectual process, is an "ensuing chain of commitments", which initiate the development of two contrasting cycles: The first, a cycle that increases the resources available to the entrepreneur by increasing committed stakeholders. The second, increasing the constraints imposed by the increasing number of committed stakeholders, effectively converging the pool of potential goals until a point where it reaches specific goals embodied in an effectual artefact (Sarasvathy & Dew 2005). For example, committing a new investor to the venture will increase the (financial) means, but typically also result in new constraints being put on the venture, by this new stakeholder.

An important aspect for a successful effectual process, is therefore to allow this process to unfold, and not initiate the process with a specific goal in mind, as this will hinder the commitment of effectual stakeholders with differing goals.

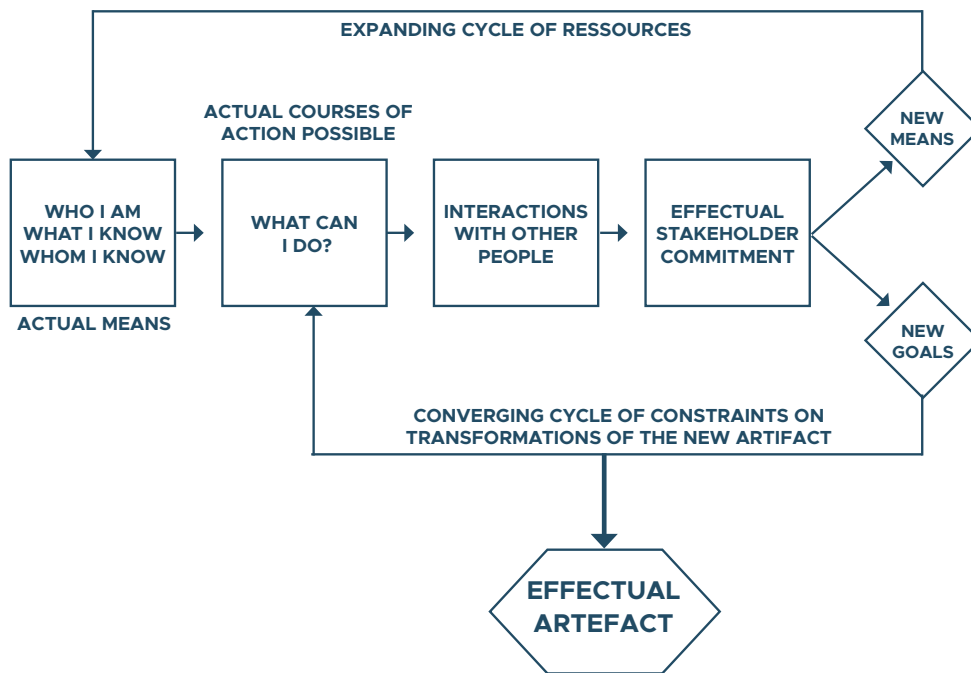


Figure 2 A dynamic model of the effectual network and the new market as an effectual artefact (Sarasvathy & Dew 2005)

As described by Read and Sarasvathy (2005) there are a number of elements that the entrepreneur must address. At the same time, there is an overall progression of the effectual process towards the effectual artefact (Sarasvathy & Dew 2005). However, it is key to the entrepreneurial process to address the elements and go through the overall progression without pre-defined stages. Otherwise, it will not be possible to remain nimble and follow the effectual principles, which allows the entrepreneur to effectively operate in the face of great uncertainty. In other words, while the venture does converge toward the effectual artefact (e.g. a proven, successful business model) over time, this process does not have (and cannot have) a predefined structure.

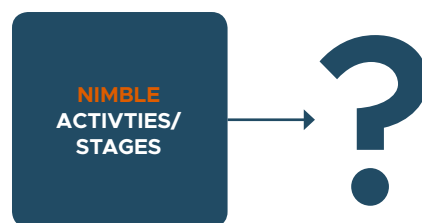


Figure 3 The effectual process is characterized by a lack of pre-defined stages and tasks to remain nimble and able to follow the effectual principle and effectively operate with non-predictive control in the face of extreme uncertainty.

Notably, as the venture progresses, and the means and constraints increase, the uncertainty decreases and the goal gets more defined. This gradually decreases the need for effectual reasoning, while simultaneously making causal reasoning more relevant (Sarasvathy 2008).

KEY TAKE-AWAY: THE EFFECTUAL PROCESS IS CHARACTERIZED BY A LACK OF PREDEFINED STAGES AND ACTIVITIES. THIS IS A CONSEQUENCE OF THE NEED TO REMAIN NIMBLE AND FOLLOW THE EFFECTUAL PRINCIPLES. HOWEVER, THE EFFECTUAL PROCESS DOES FOLLOW AN OVERALL PROGRESSION TOWARD THE EFFECTUAL ARTEFACT.

2.2.4. Effectuation; in summary

The exploration of current effectuation research has shown that the entrepreneurial ventures face the distinct challenge of dealing with extreme uncertainty.

Under such conditions, any prediction of future outcomes is uncertain and not a viable basis for decision making. Instead, the entrepreneurs must adopt an effectual mode of reasoning, with a means-driven approach that utilizes techniques of non-predictive control (Sarasvathy 2008).

This approach leads the entrepreneur through the effectual process, which is characterized by an overall progression through a chain of commitments, but lacks pre-defined stages or activities (Sarasvathy & Dew 2005).

2.3. Dealing with behavioral challenges: Behavioral Design

This section establishes behavioral design as an appropriate theory for understanding an effective process to deal with behavioral challenges.

Following which, it examines the characteristics of behavioral design and what constitutes an effective behavioral design process.

2.3.1 Behavioral design; a promising way to effectively deal with behavioral concerns

Human behavior is a complex area, arising from diverse psychological factors, and from social, societal and contextual influences (Darnton 2008a). To effect behavior, one has to both be able to understand those complex underlying factors, as well as effectively promote interventions to change them, and ultimately change the desired behavior.

Behavioral design bridges the understanding of behavior and design practices to effectively create design intervention that impacts and changes behavior.

Existing research finds a correlation between effective behavioral design processes and successful behavior change (e.g. Cash et al. 2017; Darnton 2008b).

Based on this, behavioral design is viewed as an appropriate framework for this thesis. The following section examines the approach to entrepreneurship that effectuation entails, in more detail.

2.3.2 The behavioral design approach – dealing with complexity and context dependency

The key feature of behavioral design, is that it has the distinct challenge of dealing with human behavior.

Human behavior is especially complex and goes across individual and societal factors drawing on several disciplines, predominantly psychology, sociology and economics (Darnton 2008a).

In addition, behavior is very context-dependent (Cash et al. 2017; B. J. Fogg 2009b; Darnton 2008b).

In order to deal with these distinct characteristics of human behavior, behavioral design promotes an approach that values early, and consistent, project goal definition to effectively navigate the complexity (Cash et al. 2017). Based in the goal at hand, behavioral design promotes the thorough exploration of possible intervention strategies, to select and refines the one that appear most likely to reach the pre-determined goal effectively by the given means (realized through design interventions) (e.g. Cash et al. 2017; B. J. Fogg 2009b; A Selvefors et al. 2011).

To ensure consistency between the frameworks, what was established about modes of operation in the previous section 2.2. This approach can be viewed as a causal mode of reasoning as presented in effectuation. In effectuation, causation is distinguished by selecting between given means to achieve a pre-determined goal (Sarasvathy 2001).

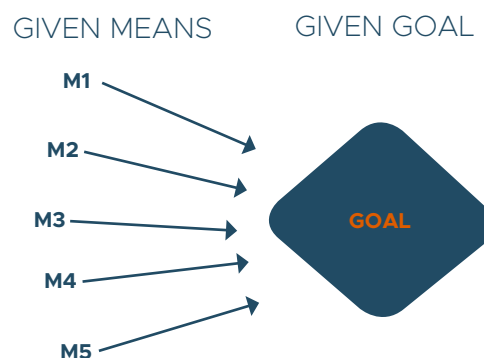


Figure 4 Due to the complex and very context-dependent nature of human behavior, behavioral design presupposes a predominantly causal mode of reasoning that establishes a pre-determined goal and select between different means to reach that goal. Figure inspired by Sarasvathy (2015).

KEY TAKEAWAY: IN DEALING WITH THE COMPLEX AND HIGHLY CONTEXT-DEPENDENT NATURE OF HUMAN BEHAVIOR AN EFFECTIVE BEHAVIORAL DESIGNER SHOULD ASSUME A CAUSATIONAL MODE OF REASONING BASED IN A GOAL-DRIVEN APPROACH THAT ALLOW THE DESIGNER TO EFFECTIVELY PREDICT LIKELY SUCCESSFUL DESIGN INTERVENTIONS.

2.3.3 The behavioral design process – progression through pre-defined stages and activities

Design processes in general can be viewed as the transformation of ill-defined problems to well-defined solutions (Cross 2008).

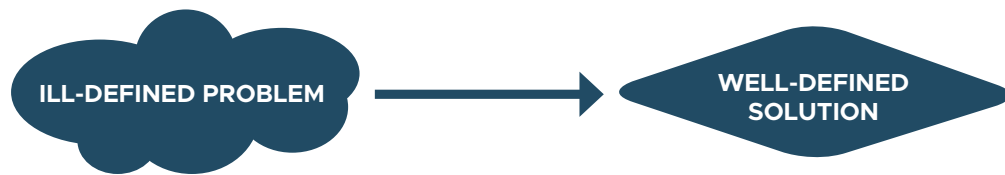


Figure 5 Design Process as a transformation of ill-defined problems to well-defined solutions

This is also true for the behavioral design process, in addition, behavioral design is distinct in that it specifically has to deal with the complex and highly context-dependent nature of human behavior, as explained above.

The overall approach of behavioral design is characterized by being a structured process with specific and pre-determined stages and activities that can be condensed into two phases; exploring and defining target behavior and developing and testing a corresponding design intervention.

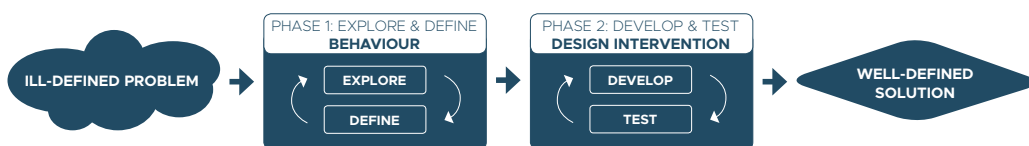


Figure 6 Overall the Behavioral Design Process can be viewed as a structured process with two phases; Explore & Define and Develop & Test

The activities serve specific purposes, and each stage is dependent on the outcome of the previous stage and appropriate execution of the associated activities.

2.3.3.1 Phase 1: Exploring & defining target behavior

Effective exploration and defining of the target behavior is key to a

successful behavioral design process. However, both exploration and definition are dependent on a number of activities being conducted in a specific way to be effective.

In the following, the key characteristics of the stages and activities in the behavioral design process is explored.

Exploring

A number of aspects are especially important with the exploration of behavioral problems.

First, determining the specific elements associated with the behavioral problem have been highlighted as a key prerequisite of the behavioral design process (e.g. Cash et al. 2017; Selvfors et al. 2011; B. J. Fogg 2009b). For example, Fogg (2009a) urges to “*pinpoint why people aren’t performing the [desired] behavior*”, and suggest using the elements of Fogg’s behavioral model (B. J. Fogg 2009a); lack of motivation, lack of ability, a lack of a well-timed trigger to perform the behavior, or a combination of them, to do so.

Behavioral elements like social norms, environment, social context, personal factors are generally considered very complex and context-dependent (Cash et al. 2017), and therefore require mapping for each new intervention (Cash et al. 2017; B. J. Fogg 2009b)

To identify and understand the behavioral elements, behavioral designers can use a multitude of data-sources, that can roughly be categorized under *theoretical* and *tangible* data.

The theoretical data is associated with theoretical constructs. Most prominently, descriptive models like the model proposed by Tromp et al. (2011); social responsible design theory, that describes how desired social behavior can be influenced by both individual and collective concerns. Or the above mentioned; Fogg’s behavioral model, that describe 3 behavioral factors that must occur at the same time for a behavior to be constituted (or changed); motivation, ability and trigger (B. J. Fogg 2009a).

Theoretical models have proven effective to decipher problem behavior and understand underlying factors that influence it, and are a key element of behavioral design (Zachrisson & Boks 2012; Darnton 2008b; Cash et al. 2017). However, they will rarely be specific to the behavioral problem nor the target behavior and will therefore often need to be complimented with data specific to the behavioral problem and target behavior (Cash et al. 2017).

Tangible data is associated with data specific to the behavioral problem and target behavior and is typically obtained through field-studies (e.g. Cash et al. 2017; Fogg n.d.). Tangible data is an important part of the behavioral design process where it serves to compliment theory, and asses how well theoretical models predict the specific behavior (e.g. Cash et al. 2017; Darnton n.d.). As well as provide testable and

measurable hypothesis for subsequent developing and testing (B. J. Fogg 2009b; Cash et al. 2017).

Importantly, Cash et al. (2017) found a substantial difference in projects success when including theoretical and tangible descriptions of behavior change: “*Where both perspectives are described probability of success is 75%. However, where tangible or theory is considered in isolation probability of success is reduced to 20% and 70%, respectively*”. In their findings, Cash et al. (2017) especially highlight the need for tangible understanding in the subsequent stage of “real-world” testing of the design intervention. However, Cash et al. (2017) also describe a main indicator for the success of the field study as prior effective theory-work through desk research.

An important aspect of conducting both explorative work (and subsequent real-world testing of the design intervention) in the behavioral design process, is ensuring that the insights reflect actual behavior. Several sources (e.g. B. J. Fogg 2009b; Cash et al. 2017; Darnton 2008b) point to that there often is a difference between how people say they will behave and how their actual behavior is.

Qualitative data, such as interviews and qualitative surveys, will typically reveal people’s attitudes and perceptions of (their) behavior, and as such usually reveal people’s perception, motivation and intention towards their behavior rather than their actual behavior. While quantitative data, such as observations, will be more likely to reveal how people actually behave.

Field work that yield qualitative data about peoples’ perception, motivations and intentions can be valuable in the behavioral design process to extent the understanding of the behavioral problem and target behavior. For example, to shed light on whether people have an intention to perform the target behavior. However, testable and measurable hypothesis should be based in observations and quantification of observational data with respect to the target behavior (Cash et al. 2017).

Defining

As mentioned in the previous section one of the key characteristic of human behavior is that it is very context-dependent, and a key characteristic of the behavioral design process is to define a *specific* target behavior as well as a specific target population.

Proper definition of target behavior is strongly linked to the exploration of associated behavior described above, and it consist of defining both the behavioral problem(s) as well as the associated target behavior(s) (e.g. B. J. Fogg 2009b; Darnton 2008b; Cash et al. 2017).

Defining the problem behavior is the first step of the behavioral process and continuous through phase 1. One of the key characteristics is that it must provide clarity in order to be effective for the subsequent stages

(Cash et al. 2017; B. J. Fogg 2009b; Selvefors et al. 2011; Darnton 2008b). Furthermore, Cash et al. (2017) showed that it needed to be aligned with the greater product development efforts in order to be successful.

Defining the problem behavior is done in synergy with exploration of the associated behavior, and by continuously defining problem behavior aids the proper scoping for explorative work.

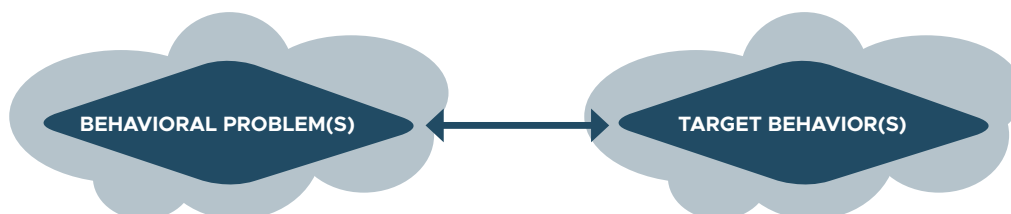


Figure 7 Defining behavioral problem(s) and target behavior(s) is a key aspect of behavioral design

Following a clear definition of behavioral problem(s) and associated target behavior(s), the process of defining the actual behavioral elements that will be addresses through the subsequent design interventions is commenced (Darnton 2008b; B. J. Fogg 2009b), and continued during the development phase (Cash et al. 2017).

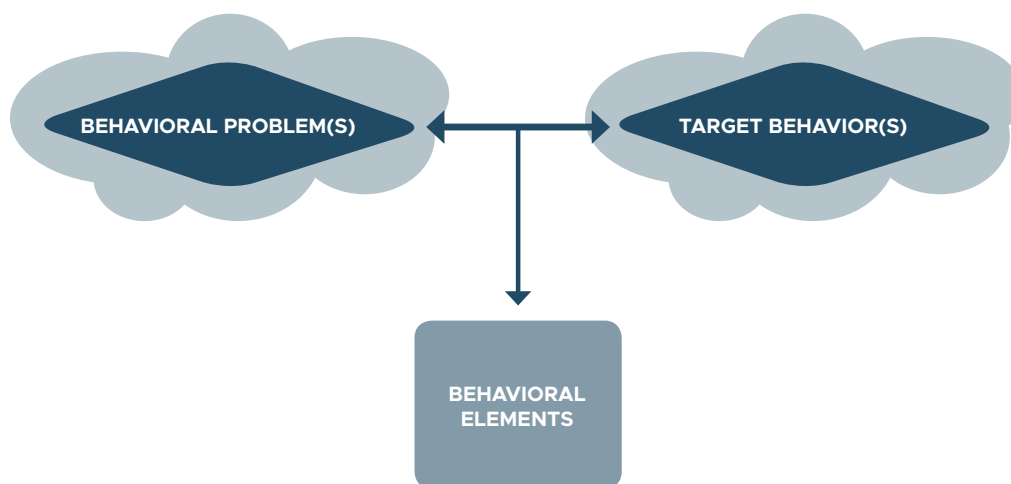


Figure 8 Defining behavioral elements is another key aspect of behavioral design, and should be done in oth phase 1 and phase 2

In summary, the first phase emphasizes the data-driven and focused exploration of behavioral problem(s), target behavior, and behavioral elements through multi-dimensional data-sources and continuous definition work, in order to deal with the complex and context-dependent nature of human behavior.



Figure 9 Phase one of the behavioral design process is centered around exploring and defining

2.3.3.2 Phase 2: Develop and test

The first phase was centered around the behavioral problem with the output of a well-defined and well-explored behavioral problem(s), target behavior(s), and some of the relevant behavioral elements. The second phase is centered around realizing the target behavior through design intervention(s).

Develop

One of the key characteristics of the development efforts in the behavioral design process, is that it rely heavily on the results of the previous phase with the intervention design work based in the definition of the target behavior (e.g. Cash et al. 2017; Fogg n.d.; Darnton n.d.). Importantly, the target may consist of several related behaviors, which in that case should be split up into different design processes for the entirety of this phase (Cash et al. 2017).

Several scholars (e.g. Michie et al. 2008; Cash et al. 2017) emphasize the need to continue the approach from the previous phase and utilize theoretical constructs to guide the development and further determine the relevant behavioral elements, such as behavior change strategies. Hence a key task is to outline and select appropriate behavior change strategies. And like the descriptive behavioral models described in the previous section, the prescriptive frameworks for behavior change strategies are rooted in theory, and mainly focus on how and when to change behavior. For example, the four types of influence framework proposed by Tromp et. al. (2011): coercive, persuasive, seductive and decisive, which all have different strength and salience of influence on the user (as well as ethical concerns). And the framework of informational or structural interventions that proposes different means to reaching behavior change (i.e. internal or external factors)(Steg & Vlek 2009). Both speak mainly to how behavior may be changed through different means to influence the user and aspire to the desired behavior. While a framework like antecedent or consequence intervention that proposes different views on where in the behavioral process a behavior should be changed (Abrahamse et al. 2005), prescribe when to influence in a behavioral process but does not prescribe how to do that.

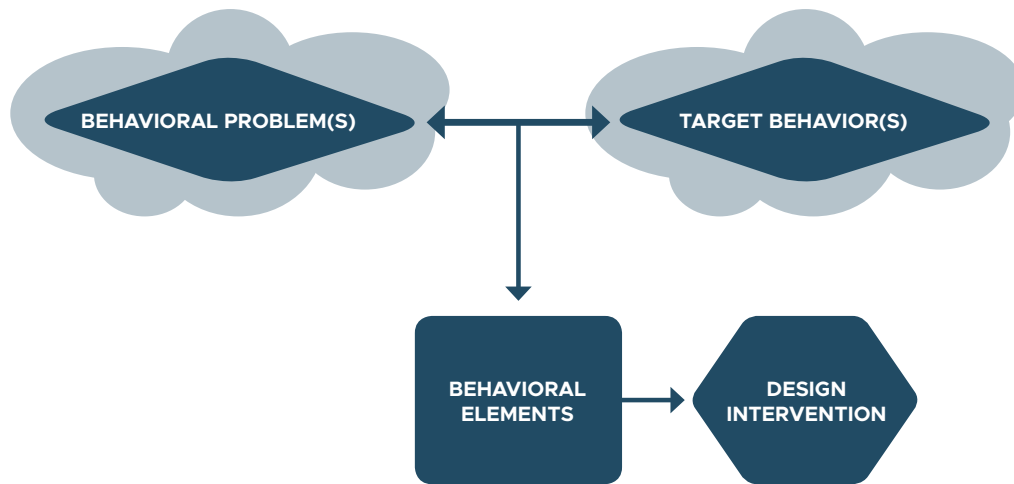


Figure 10 The design intervention(s) is developed based on well-defined behavioral problem(s), target behavior(s), and behavioral elements.

Test

Just as “real world” explorative work was emphasized in the previous phase to assess how well the theoretical predictions correlated with “real world” behavior. So, does the highly complex and contextual nature of behavior require “real world” testing of the proposed design intervention.

Two aspects of design intervention testing are highlighted in the behavioral design process:

First, the need for several tests and an iterative process of testing and refining (Cash et al. 2017; B. J. Fogg 2009b). Fogg (2009) even go as far as to suggest that “*ideally, the cycle should be just a few hours*”.

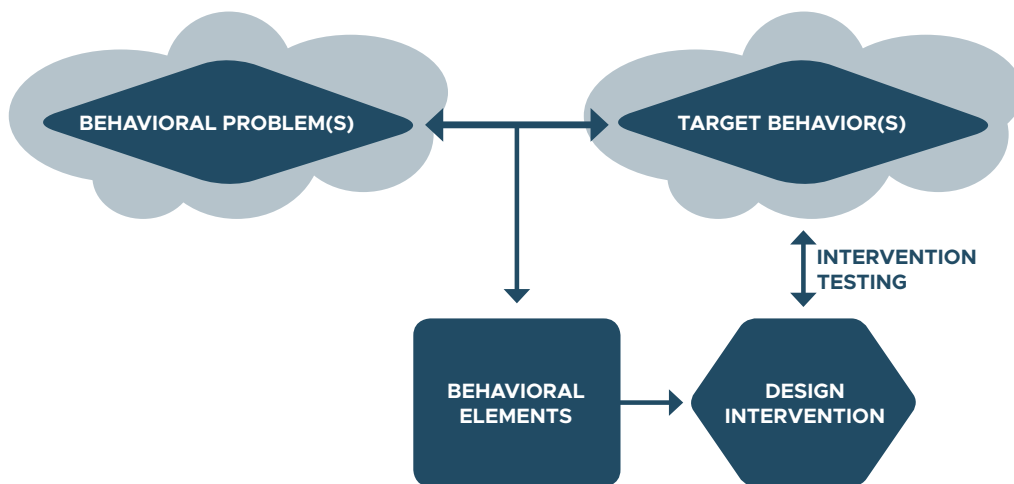


Figure 11 The design intervention is iteratively tested and refined

Second, the importance of testing each intervention, and to do so against the quantified quantitative assessment from phase 1 to truly measure the impact of the intervention (Cash et al. 2017).

Success of the latter is therefore very dependent on the work done in the previous phase, and so is the success of the design intervention ultimately.



Figure 12 Phase two is centered around develop and testing the design intervention.

the second phase emphasizes the continued use of theoretical constructs as well as a strong reliance on the work done in the previous phase in regard to intervention development and testing, in order continuously ensure actually impact the intended behavior sufficiently.



Figure 13 The behavioral design process follows a process with pre-defined stages and activities, that allow the behavioral designer to effectively address the given goal related to behavior change effectively, as well as effectively predict likely successful design interventions.

KEY TAKE-AWAY: THE BEHAVIORAL DESIGN PROCESS IS CHARACTERIZED BY A PROCESS WITH PRE-DEFINED STAGES AND ACTIVITIES THAT SHOULD BE FOLLOWED TO EFFECTIVELY DEAL WITH THE COMPLEX AND CONTEXT-DEPENDENT NATURE OF HUMAN BEHAVIOR.

2.3.4 Behavioral design; in summary

The behavioral design process faces the distinct challenge of dealing with human behavior, that is characterized by being complex and very context-dependent (Darnton 2008b).

To effectively deal with the complexity and context-dependent nature of human behavior, behavioral designers should assume a causal mode of reasoning based in a goal-driven approach to ensure consistency and strong causal link between activities.

This approach leads the behavioral designer through the behavioral

design process, which is characterized by having pre-defined stages with specific activities, that are dependent on the proper execution of each other in order to be effective.

2.4 Effectuation & behavioral design – a comparison

In comparing the processes for being an effective entrepreneur and an effective behavioral designer, as proposed by effectuation and behavioral design, respectively. It is clear that the processes impose conflicting demands on the entrepreneur, namely with respect to general approach and process.

2.4.1 Approach

Effectuation and behavioral design deal with different challenges. While effectuation deal with the challenge of extreme uncertainty characteristic of entrepreneurial activities, behavioral design deal with the challenge of the complex and highly contextual nature of human behavior.

Accordingly, their respective approaches reflect that difference. Where effectuation promotes a means-driven approach, that allow a nimble process and adherence to the effectual principle, behavioral design promotes a goal-driven approach that ensure causal links and the (likely) prediction of an effective design intervention.

2.4.2 Process

Following the different in approach, the effectual process has very different characteristics compared to the behavioral design process. Where the effectual process is progressed through a chain of commitments, and value the lack of pre-defined stages and activities, as well as a general lack of sequence in the activities, to be able to stay nimble and follow the effectual principles. In contrast, the behavioral design process is progressed through a pre-defined stages and activities, to effectively deal with the complexity and highly context-dependent nature of human behavior.

2.5 Research framework

Based in the findings from the literature review, the following section presents the research framework for this thesis.

The basic theoretical foundation for this thesis is based in a comparison of the entrepreneurial process, as viewed through the lenses of effectuation, and the behavioral design process.

Specifically, the differences in general approach. As well as, the different characteristics of an effective effectual and behavioral design process, respectively.

The literature review points to especially two conflicting demands in the intersection of an effective entrepreneurial process and behavioral design process:

- An effective entrepreneurial process is characterized by a means-driven approach in order to deal with the extreme uncertainty entrepreneurs faces. In contrast, behavioral design points to a goal-driven approach in order to deal with the very context-dependent and complex nature of human behavior.
- An effective entrepreneurial process is characterized by having limited pre-determined stages and activities in order to remain nimble. In contrast, an effective behavioral design process is characterized by pre-determined stages and specific activities.

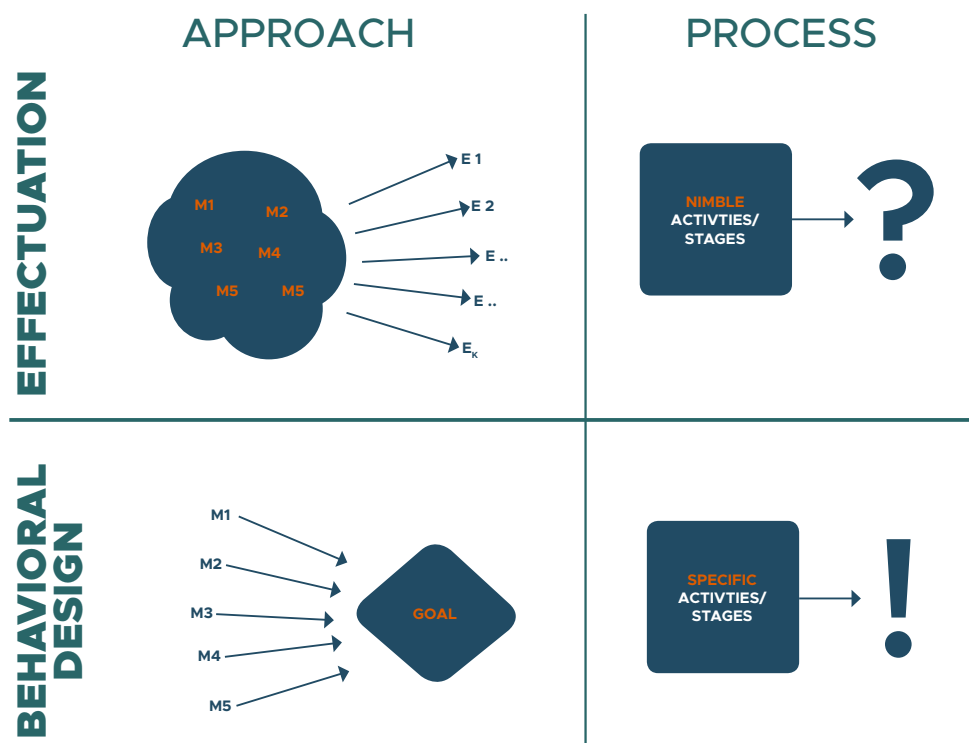


Figure 14 research framework

This research framework forms the theoretical basis for the research in this thesis and presents the conflicting demands of entrepreneurial processes and behavioral design processes, that MedTech spin-outs faces.

It has now been established that the process of being an effective entrepreneur and an effective behavioral designer, respectively, have conflicting demands, that may prove a challenge to navigate for the MedTech spin-outs.

However, very limited research exists on how the spin-out entrepreneurs manage this navigation in practice. Only a few studies, including Agogué, Lundqvist & Middleton (2015), concern both effectuation and design theory. However, the focus is on exploring the effectuation / causation dynamic through the lens of behavioral design theory, rather than directly on the intersection between design and effectuation. This is also evident by the choice of the C-K theory of design, which is not particularly suited for addressing behavioral concerns.

Based on the literature review, it was therefore clear that obtaining additional new data would be highly beneficial in the further investigation of the area.

As described below, conducting an explorative study was determined as the appropriate method for better understanding how MedTech spin-outs navigate these conflicting demands *in practice*.

3 METHODOLOGY

After establishing a research framework and the need for further investigation, this chapter proceeds with outlining the research design of the explorative study.

The important research design choices are explained. The main considerations for the interview-guide is subsequently outlined. Finally, the methods for case selection, interviewing, and analysis are addressed.

3.1 Research design: Multiple case study

Following the literature review, a theory-building approach was found appropriate. And a qualitative multiple case study methodology was adopted.

The qualitative research approach was preferred as the aim of the research was to examine a contemporary phenomenon within its real-life context, as opposed to the occurrence of a phenomenon (Yin 1984).

The case study approach was adopted, as it is particular appropriate for research areas where existing theories are considered under-explored or inadequate (Eisenhardt 1989; Yin 1984).

The case study approach have relevant strengths like novelty, testability, and empirical validity, which is key in theory-building research (Eisenhardt 1989). Further, qualitative case studies' strength is investigating a case in-depth and shed light on how and why questions (Yin, 2003).

However, the case study approach also holds significant weaknesses, which the author has to be acutely aware of. Namely , the risk of basing theory in idiosyncratic phenomenon leading to difficulty in reaching generality of the theory and instead produce narrow and idiosyncratic theory (Eisenhardt 1989). At the same time, the case study approach is rich in data, but it lacks the overall perspective that more quantitative approaches usually produce. This makes it difficult to assess what data is the most important, as well as what relationships are the most important and generalizable and which are merely idiosyncratic (Eisenhardt 1989).

Case study research may include either single or multiple case studies (Yin 1984). Multiple case studies are generally considered more robust compared to single case studies, as they provide exploration of a phenomenon in several settings (Eisenhardt 1989).

Following the case selection criterions in sections 3.3.2, a total of 6 respondents from 4 different spin-outs were included in the thesis. An additional 2 entrepreneurs from 2 other start-ups were interviewed

but were excluded by the spin-out criteria as their respective start-ups could not be considered spin-outs.

Notably, by the last interviews only limited new relevant data emerged, suggesting a reasonable level of saturation. However, some new information did emerge by the last interview, and it is conceivable that new themes or fields would have emerged, had time permitted finding additional cases and respondents within the case selection criterions, thus increasing the saturation. Although, the themes identified and explored in this thesis, were well-established across the cases suggesting that it is reliable within the framework and chosen method of this thesis.

3.2 Case interviews

In this section, the main considerations for investigation areas, interview-method and interview-guide development are explained. Afterwards, the interview method is addressed.

3.2.1 Investigation areas

Following the literature study had established the conflicting elements of the effectual process and the behavioral design process, the case study was centered around the question of how the MedTech spin-outs navigated those conflicting elements.

4 investigation areas were identified, and constituted the basis for developing the interview-guide:

1. Context of the MedTech spin-out

It was considered important to gain insights into the context of the MedTech spin-out for the subsequent analysis and comparability between MedTech spin-outs.

2. General approach

The findings in the literature review established the process approach as one of the main conflicting elements between the effectual process and the behavioral design process. It was considered important to understand what characterized the MedTech spin-outs general approach.

3. Available means

Understanding what means are generally available for MedTech university spin-outs was a vital part of understanding their process. Importantly, the definition of means used on this study, follows the definition by Sarasvathy (2001) on individual level, and includes the following:

- Who I am: traits, tastes, and abilities
- What I know: Knowledge corridors
- Whom I know: Social networks

4. Approach to behavioral concerns

Due to the conflicting elements discovered in the literature study, as well as the overall research question, it was considered especially important to understand how the MedTech spin-outs approached behavioral concerns, and what characterized that process.

The full interview guide can be seen in Appendix A.

3.2.2 Interview method

Following the choice of a qualitative approach, the face-to-face interview approach was chosen. The face-to-face interview ranges between the two extremes; unstructured and fully structured interview (Robson 1993).

The unstructured interview is very similar to a conversation, where the interviewee responds freely, and the interviewer asks few questions and tries to follow up on relevant points (Robson 1993). The fully structured interview, on the other hand, is based on pre-determined set of questions asked and the responses are recorded on a standardized schedule (Robson 1993).

The un-structured interview was considered too disorganized to ensure (relative) comparability between cases, while the fully structured interview was considered too rigid to properly get an understanding of the nuances of the cases (Robson 1993). Furthermore, the explorative nature of this study meant that having the ability to go “off script” to follow up on unexpected insights in the interviews, was considered essential. Therefore, the method of semi-structured interview was chosen instead.

The semi-structured interview is more structured than the unstructured interview, but more agile than the fully structured interview (Robson 1993). The semi-structured interview is based in an interview guide with a list of questions that the interviewer has prepared beforehand, but it still follows the flow of the conversation. It allows for changing the order of the questions, the wording of the question to fit the situation, leaving out questions that seem inappropriate, or add questions that are relevant for that particular interviewee (Robson 1993). The fact that all interviews are based in the same interview guide, keep the interview data consistent and comparable. At the same time, the semi-structured interview enabled the interviewer to record the nuances and adapt to the differences in the respondents.

3.2.3 Interview-guide development

Overall, the interview-guide development follows the methodology for semi-structured interviews set out by Robson (1993).

Development of the interview-guide was centered around ensuring

openness and clarity between the interviewer and the interviewee. Questions were formulated to help answer the research question, without being leading to specific answers.

The author prepared the wording of the overall topics and associated main questions. In addition, the author prepared a number of probing- and follow-up questions, and alternative phrasings and repetition questions, as well as introductory and closing comments (Robson 1993).

The goal of adding of probing- and follow up questions and utilizing techniques such as asking for elaboration or opposing views, was to get beyond interviewees' espoused theories and personal (misconceived) inclination, in an attempt to accommodate the interviewers (perceived) agenda.

An outline of the main topics and key questions can be found on the next page.

The entire interview-guide can be found in Appendix A.

3.2.3 Interview set-up

All the interviews were conducted one-on-one, with the author as the interviewer. While conducting the interviews, the author took notes on important insights and aspects that warranted follow-up questions. The author succeeded in managing conducting the interviews based on the interview guide, taking notes, and follow up on important points, yet it had might been an advantage to have been two researchers with one focused on conducting the interview and the other focused on the notes and other practicalities. However, the literal one-on-one approach is likely to have created a more personal connections with the interviewee and facilitate more openness. Besides it was not practical possible as only one researcher was devoted to this study.

Each interview was initiated with a short introduction of the purpose and scope of the interview, as well as a re-iteration of the time-frame and appreciation for the interviewee's participation. In addition, it was emphasized that there was no right or wrong answer, but rather an interest in their experiences as an entrepreneur. This had been adapted following one of the respondents requested the interview questions beforehand to "prepare the right answers",

As part of the introduction, the author would obtain permission to record the interviews, after which the recorder was activated.

Following the short introduction, the actual interviews were started with an introductory question such as; "Tell me about the start-up". This was considered an "easy" question for the respondent as this was conceivably something they were very familiar and excited to talk about, and a good way to "warm up" the respondent and begin building trust. In addition, it was considered an effective way to ensure a mutual understanding of the spin-out.

QUERY	AIM
TELL ME ABOUT THE START-UP?	WARM UP / INSIGHT INTO START-UP
<p>HOW WOULD YOU DESCRIBE THE REASONS THAT YOU JOINED THE START-UP?</p> <p>HOW WOULD YOU DEFINE THE SUCCESS OF THE START-UP?</p> <p>HOW DOES [ASPIRATION] RELATE TO [DEFINITION]?</p>	TO GAIN INSIGHTS INTO THE ASPIRATION OF THE ENTREPRENEUR, AND THE INTERPLAY WITH THAT AND THE START-UP DEVELOPMENT
<p>HOW WOULD YOU DESCRIBE THE MOST IMPORTANT STEPS TO REACH [GOAL]?</p> <p>HOW WOULD YOU DESCRIBE THE MOST IMPORTANT ACTIVITIES IN THE STARTUP?</p>	TO GAIN INSIGHTS INTO THE PRIORITIES OF ACTIVITIES
<p>HOW WOULD YOU DESCRIBE THE ACTIVITIES YOU WORK WITH?</p> <p>HOW WOULD YOU DESCRIBE YOUR APPROACH TO THOSE ACTIVITIES?</p>	TO GAIN INSIGHTS INTO THE APPROACH THE ENTREPRENEUR EMPLOYS.
HOW WOULD YOU DESCRIBE THE TYPES OF METHODS, DATA-SOURCES ETC. THAT YOU USE?	TO GAIN INSIGHTS INTO THE METHODS & DATA-SOURCES ENTREPRENEURS USES.
HOW DO YOU DETERMINE IF YOU HAVE SUCCESSFULLY SOLVED A TASK?	TO GAIN INSIGHTS INTO THE DETERMINATION OF SUCCESSFULLY COMPLETED TASK.
HOW WOULD YOU DESCRIBE YOUR TRAITS AND ABILITIES?	TO GAIN INSIGHTS INTO THE MEANS/RESOURCES AVAILABLE TO THE ENTREPRENEUR?
HOW WOULD YOU DESCRIBE YOUR EDUCATION, EXPERTISE, AND EXPERIENCE?	
HOW WOULD YOU DESCRIBE YOUR PROFESSIONAL AND SOCIAL NETWORK?	
<p>YOU MENTIONED [BEHAVIORAL ASPECT] WAS A PRIORITY, HOW HAVE YOU APPROACH THAT?</p> <p>HOW WOULD YOU DESCRIBE THE TYPE OF ACTIVITIES, THAT YOU HAVE ENGAGED IN TO EXPLORE [BEHAVIORAL ASPECT]?</p> <p>HOW WOULD YOU DESCRIBE THE TYPE OF DATA THAT YOU HAVE RELIED ON?</p>	TO GAIN INSIGHTS INTO THE CURRENT APPROACH TO BEHAVIORAL ASPECTS.

Figure 15 Outline of Interview Guide

Following the introductory question, a dynamic approach to the interview was employed. As outlined above, the overall structure of the interview guide, and especially the overall investigation areas, were kept in mind, while otherwise following the flow of the conversation.

By authorization of the interviewees, all the interviews were recorded and subsequently transcribed. The transcriptions can be found in Appendix D.

3.3 Cases

In this section, the case selection criteria are outlined, and a description of the included cases is provided.

3.3.2 Case selection

Sampling is an important aspect of doing research, as it ensures that the data collected is representative in answering the research question (Robson 1993). Therefore, to do effective sampling, one must identify the criteria for what cases are relevant in relation to answering the research question. This is referred to as purposefully sampling, and it is based in the researcher's typicality or interest (Robson 1993).

In answering this research question, the criteria of context, respondent and convenience were identified as important, in order to ensure relevant data to answer the research questions as well as being practically reasonable

3.3.2.1 Context criteria

Since the research question was focused on MedTech spin-outs, it was considered important to establish a clear definition of what that entailed and find first-hand cases that lived up to that definition. Accordingly, the cases were selected based on the below definitions:

First, the notion of a spin-out organization was established.

This thesis follows the definition of university spin-outs provided by Klofsten & Jones-Evans (2000), which is considered adequate for the needs to answer the research question;

“The formation of a new firm or organization to exploit the results of university research.”

Second, the notion of Medical Technology, or what is commonly referred to as MedTech, was established. This thesis equates the notions of Health Technology and Medical Technology, and follows the definition by the World Health Organization (2018):

” The application of organized knowledge and skills in the form of

devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of life.”

In addition, the selected spin-outs had to face behavioral concerns in relation to their development work, and actively seek to address these.

The sampling process did not differentiate between spin-outs at different stages of development. While spin-outs that had already gone through a process to deal with behavioral concerns could provide reflections on their decision-making in that process, spin-outs that were earlier in the process and perhaps just starting to address behavioral concerns, were expected to be able to give a more immediate perspective into their current thinking. Therefore, both early-stage and later-stage spinouts were considered relevant and the stage of development was not chosen as a selection criterion.

3.3.2.2 Respondent criteria

After establishing the criteria for case selection, it was also necessary to establish criteria for selecting the respondents from each case. Here, the main consideration was that the respondents had to have been at the center of making decisions regarding the behavioral concerns. This was considered to range between doing the actual development work to address behavioral concerns and making some of the more high-level decisions regarding how to address behavioral concerns.

3.3.2.3 Convenience criteria

As the format of a master thesis entails certain practical limitations, it was considered important to optimize the quality of data with the means in hands, within reasonable bounds.

As a qualitative approach where the respondents were met face-to-face was considered appropriate, spin-outs with the possibility of meeting within the Bay Area became a prerequisite, in order to optimize the number of in-person meetings. This was considered a reasonable criterion as the Bay Area have a substantial density of MedTech spin-outs.

Notably, one interview was done over Skype. Due to the international nature of the spin-out in question, a highly relevant member of the spinout was based in Denmark. It was decided that this interview could provide sufficient value to justify disregarding the face-to-face criteria in that singular instance.

3.3.3 Cases

This section describes the selected cases and provides an overview of the included respondents.

Case 1 is a spin-out from University of California Berkeley. It is based in a printed electronics technology.

The spin-out aims at applying the technology for the purposes of manufacturing a new generation of MRI (Magnetic Resonance Imaging) coils. The key value proposition of the coils, is based in increasing the quality of MRI scans and thus ultimately decrease the number of re-do's of MRI scans, in part because of less patient movement.

The spin-out faces a behavioral concern in relation to (un-wanted) movement of patients, which currently results in having to re-do MRI scans and/or use anesthetic treatment of patients, during the scan. The problem is particularly severe among pediatric patients.

The spin-out aims at developing a behavioral design intervention that makes the treatment more comfortable for all patients due to the lack of rigidity of their coils. It also aims to make the treatment more “fun” for pediatric patients, by introducing a child-friendly dinosaur pattern on their coils.



Figure 16 Current (rigid) MRI coils in use



Figure 17 Printed (flexible) MRI coils (prototype)

The spin-out was founded in 2016 by 4 people:

- 2 UC Berkeley professors who specializes in printed electronics and printed electronics & MRI technology, respectively. Both currently have an advisory function to the spin-out.
- 2 printed electronics Post.Doc.-student (now graduated), who now works full-time in the spin-out.

The spin-out is currently part of the Berkeley Skydeck accelerator program.

To date, the spin-out has raised a combined \$275.000 from University of California San Francisco Pediatric Device Consortium and a government funded seed fund; America's Seed Fund.

One person with a key-role as co-founder and part of the daily development team, was interviewed for the purposes of this thesis. See fig 16 on next page.

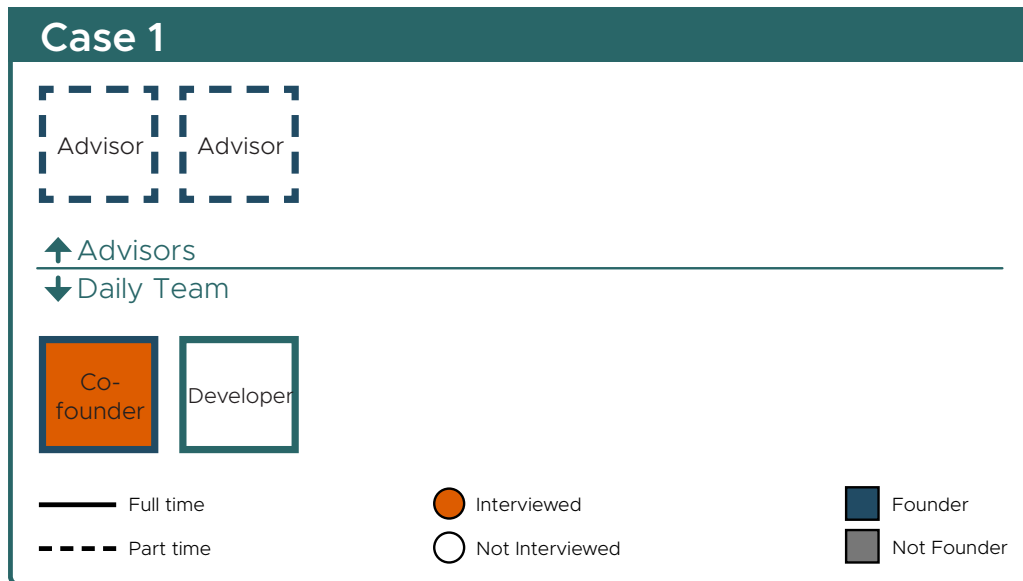


Figure 18 Overview of Case 1

3.3.3.2 Case 2

Case 2 is a spin-out from University of California Berkeley and the Technical University of Denmark. It is based in a patented photonics technology, that disguises flickering light as non-flickering light for the naked eye.

The spin-out aims at applying the technology to disguise a specific flickering light constellation that may have a decelerating effect on the progression of Alzheimer’s disease.

The spin-out faces a behavioral concern in relation to treatment compliance, which has proven a substantial issue for similar treatment regiments, namely light therapy for seasonal affective disorder. The spin-out is aiming at developing a behavioral design intervention that makes the treatment more comfortable for patients to adhere to.

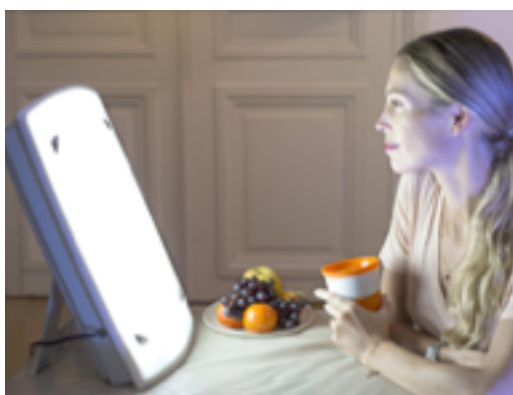


Figure 19 Depiction of a light therapy session for seasonal affective disorder



Figure 20 The current prototype of case 2.

The spin-out will be founded in the summer of 2018 by 7 people:

- 2 professors at the photonics department at the Technical University of Denmark. One of them with strong ties to UC Berkeley.
- 3 students who currently work full-time on the project and will assume full-time employment in the spin-out following their graduation and the founding of the company in the summer of 2018. One of the students is graduating with a PhD in neuroscience and the other is graduating with a master's degree in theoretical physics. The third has graduated with a masters degree in electrical engineering.
- 2 students who are currently working on the project in relation to their masters degree in engineering.

An additional 6 advisors are connected to the project, and an additional 5 master students are currently doing their master thesis in collaboration with the project.

Furthermore, for the Spring 2018 and Autumn 2017 semester, 2 groups in the course "HardTech Entrepreneurship", offered at the Technical University of Denmark, have worked on the project.

The spin-out is currently part of the UC Berkeley/Technical University of Denmark entrepreneurship program Open Entrepreneurship.

To date, the spin-out has raised a combined \$135.000 from Danish government innovation grants.

Two persons with a key-roles as (future) co-founders and part of the daily development team was interviewed for the purposes of this thesis. See fig 19 on the next page.

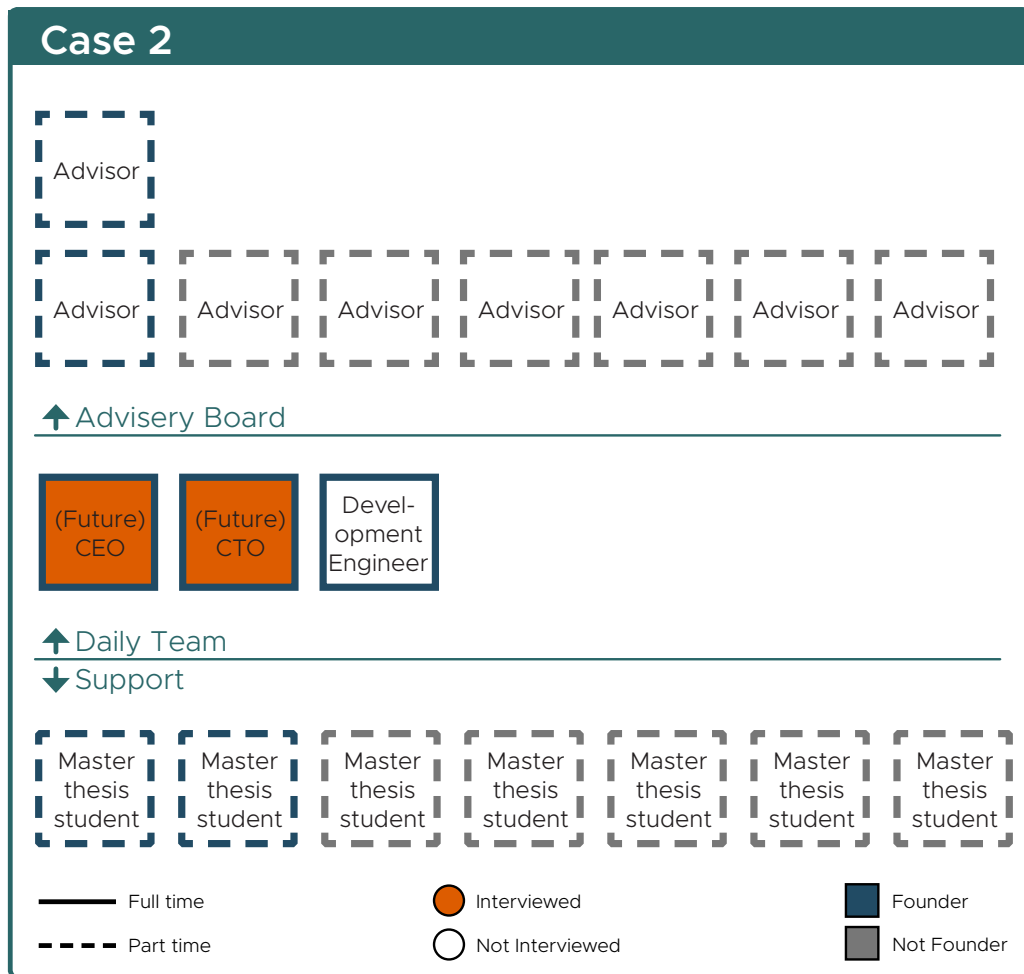


Figure 21 Overview of Case 2

3.3.3.3 Case 3

Case 3 is a spin-out of the Pontifical Catholic University of Chile. It is based in a sensor technology.

The spin-out aims at applying the technology to increase the treatment outcome of pressure garment therapy for burn survivors with severe burn wounds.

The spin-out’s goal is to develop a behavioral design intervention that makes the treatment simpler to adhere to.

The spin-out was founded in 2017 by 3 people:

- All 3 founders are currently students at Pontifical Catholic University of Chile, where they met. Their educational background is in the intersection of Design & Innovation, electrical engineering, and mechanical engineering.

To date, the spin-out has raised a combined \$27.500 from 2 Chilean entrepreneurship contests; Jump Chile and Alto Impacto.



Figure 22 Facial pressure garment mask for treatment of severe burn wounds.



Figure 23 Body pressure garments for pediatric patients.

One person with a key-role as co-founder and part of the daily development team was interviewed for the purposes of this thesis. See fig 22 below.

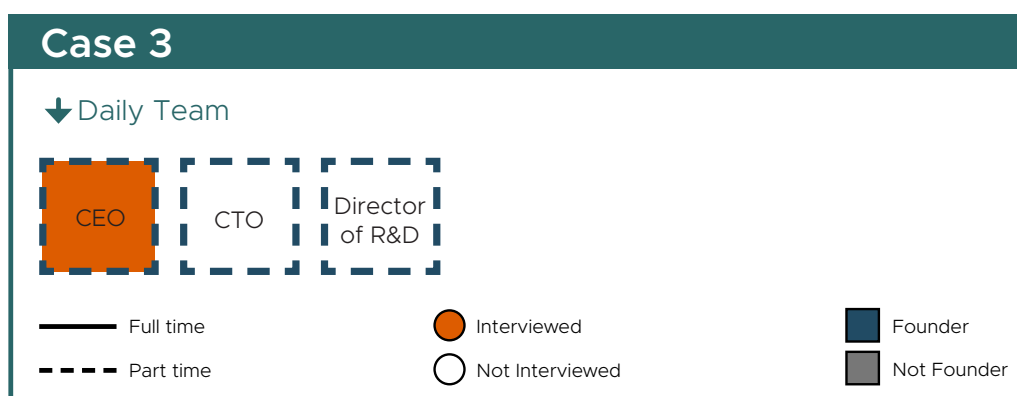


Figure 24 Overview of Case 3

3.3.3.4 Case 4

Case 4 is a spin-out from University of California San Francisco. It is based in a patented suction technology.

The spin-outs aims at applying the technology to tissue-manipulation at laparoscopic and minimally invasive surgery, as an alternative to tissue-manipulating by “grapping”. With tissue-manipulation by “grabbing”, it has proven difficult for surgeons to control the force leading to tissue-damage and sometimes severe side-effects that are difficult to detect.

The spin-out is aiming at developing a behavioral design intervention that makes it more manageable to manipulate the tissue without using

excessive force.



Figure 25 Conventional tissue manipulator with “grapping” functionality.



Figure 26 Prototype of case 4 “suction” tissue manipulator.

Was founded in 2017 by an un-disclosed number of people, at least:

- 1 surgeon, who works as Assistant Professor of surgery at the Endocrine Surgery Section as well as Director of Research as Endocrine Surgical Oncology Lab.
- 1 former master student, who now works part-time at the project.

The spin-out is currently part of the UCSF Surgical Innovations program.

To date, the spin-out has raised an undisclosed amount from the University of California San Francisco catalyst program; CTSI Catalyst.

2 people with a key-roles as co-founders were interviewed. One was part of the daily development team, the other had an advisory role. See fig 25 on the next page.

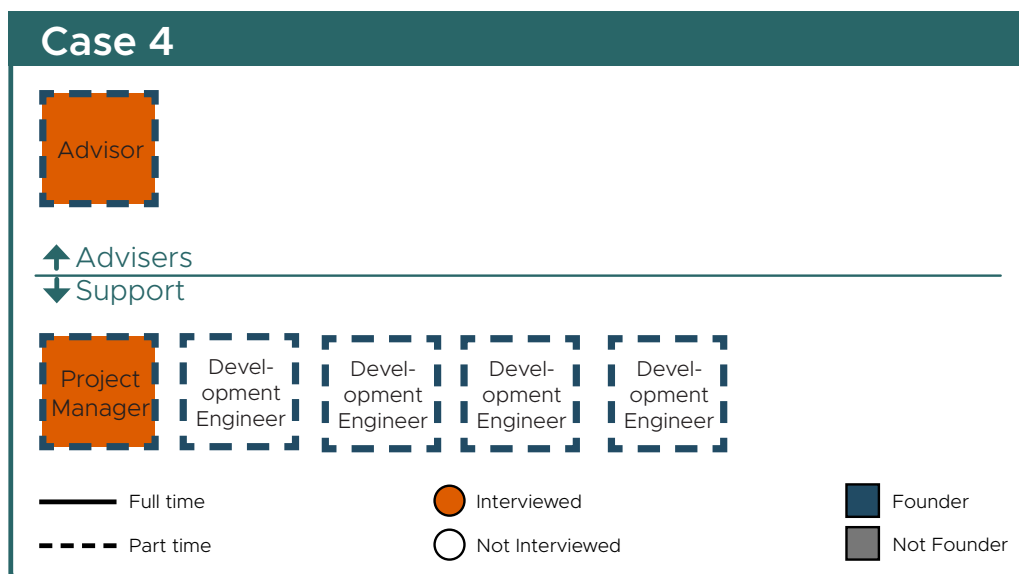


Figure 27 Overview of Case 4

3.4 Method for analyzing the interview data

One of the key challenges of qualitative semi-structured interview data, is the sheer amount of data that is gathered. A key component of the data-analysis, is therefore the ability to focus specifically on the information that will help answer the research question.

Following the literature review, a theoretical framework for the analysis had already been established (Robson 1993), and the analysis was focused on the processes assumed by the spin-out entrepreneurs through the lenses of effectuation and behavioral design.

In practice, the core findings are evolved through iterative exploration and explanation building (Robson 1993). The author went through several stages of analysis in order to establish the key findings that were relevant to the research question and appeared across the case sample.

The first step was noting down immediate areas of interest during and immediately following the interviews, and again following the transcription of the interviews. Afterwards, a more structured study of the transcript, including highlighting of important answers and noting possible themes in relation to the pre-defined research framework, was conducted. Subsequently, a comparison of notes and highlighted sections were made, and initial themes began to emerge. This led to a re-reading of the transcripts, to confirm the themes, which resulted in some adjustments. This process was then repeated iteratively, until the themes were firmly established. Once the themes were

established, digital coding was initiated and iteratively refined, until the themes could be extracted to this report. The digital coding was done in Microsoft Excel, where text-sections were divided, and each section provided a three-tier contextual coding. See example below:

14. This for whatever. rean.	ACTIVITIES	Next-step	
Respondent: So all the grants that we're applying for going to allow us to hire someone that will take care of the quality part. So, you know, made sure that everything is standardized and made sure that everything is tracked to make sure everything is whatever industry standards we need to hire consultants to figure out how regulatory pathway starts with the FDA we need to, and we have a good idea of all of these things, but we have to actually put it down on paper and start talking to the FDA and it's not like homework where you can just go and get your grade and change everything. You have to do it right the first time. And so that's, that's part of why we need to hire all these consultants and make sure			
36 that we're doing everything right. And so that's sort of the steps that we're on.	Approach	Goal-driven	hire means

Figure 28 Three-tier digital coding

The key findings are presented in the following chapter; chapter 4.

While the bulk of the analysis was done following the interviews, some of the initial steps was conducted during the data-gathering to ensure relevance and allow for minor adjustment.

4 FINDINGS

This chapter outlines the key findings from the case study.

The key findings related to the general approach is outlined. As is the key findings related to the process the respondent assumed specifically to address behavioral concerns.

4.1 General approach

The first step is to look at the respondents' general approach to their spin-outs.

4.1.1 Driven by means

In the literature it was established that a means-driven approach constituted a process, where the entrepreneur imagined possible ends based in available means and within the aspiration of the entrepreneur. Whereas a goal-driven process, on the other hand, was characterized by establishing a specific goal from which possible means to reaching that goal was imagined, and the most efficient was chosen.

Based on that framework of approaches. The spin-outs were characterized by having a predominantly means-driven approach. This meant that the entrepreneurs would predominantly imagine possibilities originating from their available means. However, this was not an absolute, nor are the notions of means-driven and goal-driven approaches considered dichotomous. The approach taken by the entrepreneurs, while most often means-driven, had traces of both means-driven and goal-driven characteristics.

A generally pronounced examples of a means-driven approach for all the spin-outs, was the initial idea behind the spin-out, which was characterized by an initial commitment by (some) of the founders, from where they imagined ends they could reach through their combined means, namely their education, skills and network. As one entrepreneur (case 2.1) explained:

“And I was like, oh, I worked with circadian. So that’s how it came about of having the starting of the conversation. And then this paper came out in nature for MIT and it was basically saying, you know, um flickering light at 40 hertz, can reduce 52 percent of plaque development in the brain of Alzheimer’s patients or Alzheimer’s mice, not patients. Um, so yes, and it was like, you know, it was really uncomfortable. It can induce epilepsy. Can we do something? And I was like, yeah, of course we can’t do that. Why don’t we just mask the light and, you know, he was like, oh, that is possible and then we created a patent and um, that’s [how the spin-out was initiated]”.

From that initial profoundly means-driven act, the entrepreneurs

would, to a large extent, continue to rely on a means-driven approach. Their means would play a pivotal role in retaining partners, choosing activities, and gaining new knowledge. For example, the entrepreneur mentioned above (case 2.1), described how her personal traits based in her past (successful) experience negotiating with fellow academic researchers had given her a distinct ability to understand this group

“I knew as a researcher myself that primary literature and being the first author [...] is something that is valuable to [academic researchers]”. This understanding enabled the entrepreneur to realize the value in authorship and leveraging this in negotiations with the researcher; “but all the analytical stuff that takes a long time, they’re willing to do it [for free] because they’re able to get a publication out of it”.

Another entrepreneur (case 4.1), described how he had deliberately chosen a means-driven methodology that, to him, seemed perhaps less obvious, when faced with a challenge of creating an ergonomic design. Instead of venturing out to attract the necessary means for an optimized ergonomic design in a goal-oriented fashion, the entrepreneur based his decision in his own existing means and imagined what he could do, based on that. In this case, that meant reverse engineering an existing solution, which was an activity within his personal knowledge corridor:

“Things that are ergonomically good for the surgeons [...] I opened it up, and if I look and I’m like, cool, cool for bar mechanism, blah, blah, blah, blah, whatever it is, and then reverse engineer that and put it into our device”.

One entrepreneur (case 1) described how he had initially struggled with figuring out how to initiate a spin-out. He had then realized the value of being closely associated with a renowned academic institution, by talking to people also associated with the institution, but with a different background than himself:

“And then you know at Berkeley there was such a good environment for people who have different backgrounds that you talk with people of whoever the business experience and then they told you they help you move forward”.

After the initial struggle, he chose an accelerator program with a strong link to the institution, in order to maintain and build on that value;

“and that’s also why we came to Skydeck because Skydeck is very good at as a very strong network of advisors of many different backgrounds and where we get our business advise basically”.

As touched upon above, an approach is rarely exclusively means-driven or goal-driven, rather it encompasses characteristics of both. This is also true for the general approach of the spin-out (and the examples above). However, the key distinction is the fact that the entrepreneurs, albeit working under a generalized aspiration, predominantly look to their available means and from that imagine possible ends.

That being said, there is also examples of the entrepreneurs assuming an approach better categorized as predominantly goal-driven. Namely, because these processes were driven by a rather specific goal with no basis in the entrepreneurs means.

A consistent example across the cases, was the work that most entrepreneurs stated to do or planned to do in relation to regulatory approvals.

For example, one entrepreneur (case 4.1) explained how the spin-out ventured out to find consultants to do the regulatory work as they did not have sufficient means within the spin-out:

“So all the grants that we’re applying for going to allow us to hire someone that will take care of the quality part. So, you know, make sure that everything is standardized and made sure that everything is tracked to make sure everything is whatever industry standards we need to hire consultants to figure out how regulatory pathway starts with the FDA we need to, and we have a good idea of all of these things, but we have to actually put it down on paper and start talking to the FDA and it’s not like homework where you can just go and get your grade and change everything. You have to do it right the first time. And so that’s, that’s part of why we need to hire all these consultants and make sure that we’re doing everything right.”

Another entrepreneur (case 2.2.) explained how the spin-out was long-term planning to accommodate regulatory and clinical requirements. For reference, the entrepreneur had previously stated that due to the uncertainty of being an entrepreneur, he would rarely plan more than a few weeks in advance.

“We’ll need to get expertise and show that something is happening [...] we will be looking for like a two year study afterwards that will show that it will slow down or stop the progression of Alzheimer’s disease.”

Which show the synergy between means-driven and goals-driven approach, and while the data show that the occurrences of the former outweighs the latter, it also shows that both are integral parts of the entrepreneurs’ approach.

KEY FINDING: THE ENTREPRENEURS GENERAL APPROACH WAS PREDOMINANTLY MEANS-DRIVEN, WITH SOME OCCURRENCES OF MORE GOAL-DRIVEN APPROACHES.

4.1.2 Aspirations

As a means-driven approach plays big role in the general approach of the entrepreneurs, it is important to look at their general aspirations that provide the framework for navigating their means.

	Case 1	Case 2.1	Case 2.2	Case 3	Case 4.1	Case 4.2
Learning experience	X	X	X		X	X
Making a difference		X	X	X		X
Sense of adventure						X
Working a (specific) great team		X	X			

Table 1 Stated aspirations of the entrepreneur

The entrepreneurs' reasons for engaging in the spin-outs was grounded less in specific goals and more in high-level aspirations. For example, 5 of 6 entrepreneurs mentioned "the learning experience" associated with working with the spin-out as one of their main aspirations for what to get out of the entrepreneurial experience. As one of the entrepreneurs (case 4.1) explained:

"I felt like I had a good amount of experience, but to actually get what I wanted from the education, I felt like it was still part of my education to keep going on this and keep learning."

4 of 6 entrepreneurs mentioned an importation aspiration being along the line of "making a difference". One entrepreneur (case 2.1) concluded:

"I think the main goal of what I wanted to do is to make a difference in any way possible."

Another (case 3) explained that the social impact was not only his aspiration, but also how he found purpose in the spin-out:

"I like to do something with social impact, actually. If it doesn't have social impact I don't know, it wouldn't make that much sense to me. Like it would be, could be, something fun to do, but I wouldn't be something that I will take maybe be thinking about all the weekend when I go out to party".

Other aspirations given were aspects like "working with a great team (case 2.1 and 2.2)" and "the adventure of it (case 4.2)".

The open-ended aspirations of the entrepreneurs allowed for rather big pivots, i.e. changes to central aspects of the start-up, such as the strategy, envisioned business model etc. One example is the entrepreneur from case 3, who based both his aspiration and sense of purpose in the notion of making a difference and having a (positive) social impact. He explained that the spin-out was considering a pivot at the time of the interview: The current goal of the spin-out was to make the process of fitting pressure-garments to treat severe burn wounds and limit permanent scarring and/or functional impairment more transparent for survivors and/or caregivers. Now the spin-out was considering making the treatment more available, through a price-decrease:

“Now [the goal] is to create garments that can be tight. But maybe you can decrease the price. [...] more available is to decrease the price.”

Another one of the entrepreneurs mentioned above (case 2.1), had stated that “making a difference” as well as “working with (this specific) team” as some of her main aspirations with the spin-outs. During the course of the interview, she explained that she was actually willing to pivot to quite a large extent, including abandoning the original idea, that had initiated the spin-out:

“I think at the end of the day, even if our light technology doesn’t work, we have such a strong team that we can build anything and be able to be successful”.

KEY FINDING: THE ENTREPRENEURS GENERALLY WORKED UNDER HIGH-LEVEL ASPIRATIONS, UNDER WHICH THEY WERE WILLING TO PIVOT SUBSTANTIALLY. THE ASPIRATIONS WERE PREDOMINANTLY CENTERED AROUND “LEARNING EXPERIENCE” AND “MAKING A DIFFERENCE”.

4.1.3 Means available to the entrepreneurs

As the entrepreneurs assumed a predominantly means-driven approach, it is important to examine what was characteristic of the means that were available to, and utilized by, the entrepreneurs.

Table 2 summarizes the means which the entrepreneurs relied upon, according to their own statements. The summary is organized across the three dimensions proposed in effectuation (Sarasvathy 2001): Personal traits and abilities (who I am), personal knowledge corridor/ education, training and skills (what I know), and personal network (whom I know).

The means available to the entrepreneurs were characterized by

being cultivated through a university setting. This was the case for both the personal traits, personal skills and, especially, the personal network dimension.

		Case 1	Case 2.1	Case 2.2	Case 3	Case 4.1	Case 4.2
WHO	Navigating academic politics		X				X
	Talking to people	X	X	X	X		X
	Reaching out to people	X	X	X	X	X	X
	Overview/delegating		X			X	X
WHAT	Educational background	X	X	X	X	X	X
	Online Research	X		X		X	
	Comprehending academic papers/research	X	X	X	X	X	X
WHOM	University ¹	X	X	X	X	X	X
	University ²	X	X	X	X	X	X
	Entrepreneurial support program (associated with university)	X	X	X	*	X	X
	Network not associated with university	X	X	X			

*Not part of an entrepreneurial support program

Table 2 Means available and utilized by the entrepreneurs

On the level of personal traits, all entrepreneurs stated that they actively used their personal traits of being good at “reaching out to people” actively, to advance the spin-out.

Most of the entrepreneurs stated that they were “good at talking to people”, while some explained that they were good at keeping an “overview” and “delegating responsibilities”. These are in line with what you would expect from entrepreneurs, where expanding the network through connecting with people with additional means is key (Sarasvathy & Dew 2005).

Notably, 2 of the entrepreneurs explained that they were good at navigating academic politics and that their spinouts benefitted from this ability. The example from one of the entrepreneurs is explained above in section 4.2.1. Such findings underline the close relation the spin-outs had to their respective universities.

On the level of personal skills, all the entrepreneurs expressed that

they relied heavily on their education. Additionally, approximately half of the entrepreneurs explicitly mentioned frequent use and reliance on online searches. As one entrepreneur (case 2.2) stated: *“Google is your friend!”*

In addition, all of the entrepreneurs explained that they frequently used academic sources and 2 entrepreneurs (case 2.1 and 2.2) even explicitly mentioned this as one of their main skills contributing to the spin-out. For example, when one of the entrepreneurs (case 2.2) was asked what his skills were, he explained that his background as a theoretical physicist had taught him how to read and comprehend difficult academic research. He subsequently explained how that had been helpful to understanding an area that he had to work with, but which was outside his immediate knowledge corridor:

“You also learned to read very difficult text and math [...] for instance I have, even though, I’m in the development of technology, I have to do a lot about the neuroscience. So, I’ve read 20 plus papers under neuroscience part.”

This again underlines the close relationship the entrepreneurs had to the university and academic research setting, and that they were able to actively leverage that in their work with the spin-out.

The network level was the dimension in which the connection to university was shown most prominently. All the entrepreneurs stated that they relied heavily on their immediate network from university (university1), as well as their entrepreneurial support program (3 of 4 cases) that was also closely associated with their respective universities.

All the entrepreneurs also relied heavily on stakeholders they had been introduced to through their immediate university network (university2). While these were not in the entrepreneurs’ immediate university network, they were often closely associated with the university, too. They were either directly part of the university, part of other universities, or partnering organizations. For example, one entrepreneur (case 1) explained how a partner at another university had played a pivotal role in the beginning of the spin-out.

“We had a trial with them, a pediatric radiologist at Stanford was a one of their partners in the research grant and she liked it very, very much and that’s based on that feedback around here.”

Interestingly, that partner kept playing a significant role and is currently testing the spin-outs prototype in-situ.

Key finding: The means available and used by the entrepreneurs was typically closely related to university and academia, as well as an ability to connect and engage with other people.

The overall approach of the entrepreneurs has now been established. The data reveals that the approach is typically means-driven with open-ended aspirations. Furthermore, it is clear that the spin-outs means are often closely related to academia and university. The next step in exploring the research question, is to look more closely at process the spin-out entrepreneurs assumed to address behavioral challenges specifically.

4.2 Addressing behavioral concerns

This section looks at the characteristics of the process the spin-out entrepreneurs assumed to deal with behavioral challenges.

Typically, the process that the spin-out entrepreneurs assumed to deal with behavioral concerns was characterized by limited planning and utilizing of intuition and a preference towards immediately available resources.

Table 3 below show an outline of the methods and data-sources the entrepreneurs relied on to address behavioral concerns.

		Case 1	Case 2	Case 3	Case 4
Exploration	Clinical expert opinion (qualitative assesment)	X	X	X	
	Intended user opinion (qualitative assesment)				X
	Proxy user opinion (qualitative assesment)			X	
Defining	Explorative work	X	X	X	X
	Personal experience		X	X	
	Intuition	X	X	X	X
Intervention Development	Intuition	X	X	X	X
	Personal experience ²		X		
	Existing (proven) solution	X			
Intervention Testing	Joint quantitative testing (based in observations)	X	X	X	X
	Semi-single qualitative assessment (based in attitudes and preferences)	X	X		X

Table 3 methods and data sources used by the entrepreneurs to address behavioral concerns

The following sub-sections will cover all 4 categories that was outlined as part of the behavioral design process in literature review in chapter 2; exploration, definition, intervention development and intervention testing, and elaborate on the activities and reasoning behind.

4.2.1 Exploration activities

The data show that all the cases did some explorative work to increase the understanding of the behavioral problems, see Table 3.

This work was centered around what can be categorized as tangible data, as it was based in practical experiences rather than constructed (theoretical) models of behavior.

In addition, the data can be considered predominantly qualitative, as it was centered around attitudes and preferences of the subjects, rather than observations of actual behavior.

The data was typically based in insights from clinical experts, rather than intended users. The rationale for this type of explorative work, appeared to be based in a belief that clinical experts were more knowledgeable and had aggregated more experience than (single) users, as well as a question of availability.

Approximately half of the entrepreneurs expressed the view that experts were more knowledgeable in relation the behavioral concern. An entrepreneur (case 1) explained:

“Patients [intended users] do not bring a lot perspective to us, uh, because uh, patients don’t really know what’s going on. If you’re lucky, your patient is knowledgeable, but then you learn as much from them that you would learn from a technologist. And then if it is someone that doesn’t have a clue, really, yeah, I had a terrible experience in my MRI. And that’s helpful because then you know, oh yeah they do.”

Another entrepreneur (case 3) explained that while he had predominantly engaged with experts like therapists and doctors, he recognized that the intended users (in this case burn survivors and their caregivers) were another important stakeholder. However, this group was less accessible to him, which was why he had not engaged them:

“And the other important stakeholders are survivors and their families, but it’s kind of complicated. Talk to them like they’re, you probably will have to be like introduced by someone and none... and there are not like enough trust to introduce us to burn patients here [US]”.

One notable exceptions to that trend, was case 4 that did rely on data from intended users; surgeons. Importantly, case 4 did have a different basis for doing that, as they had an intended user as a co-founder, which both interviewees (case 4.1 and 4.2) had stressed as important.

And which have presumably resolved the issue of availability, as well as given an inherent understand and empathy for that perspective. However, the data was to a large extent still based in qualitative assessment through interviews, much in the same way as the other spin-out cases.

KEY FINDING: THE SPIN-OUT CASES DID ENGAGE IN EXPLORATIVE WORK. THIS WAS MAINLY BASED IN TANGIBLE QUALITATIVE ASSESSMENTS, PREDOMINANTLY FROM CLINICAL EXPERTS AND PROXY USERS RATHER THAN INTENDED USERS.

4.2.2 Definition activities

Typically, the entrepreneurs engaged in definition activities to a limited extent.

Based in the literature review, the following key definition tasks have been identified; scoping problem behavior, defining target behavior, defining behavioral elements to use in the design intervention development.

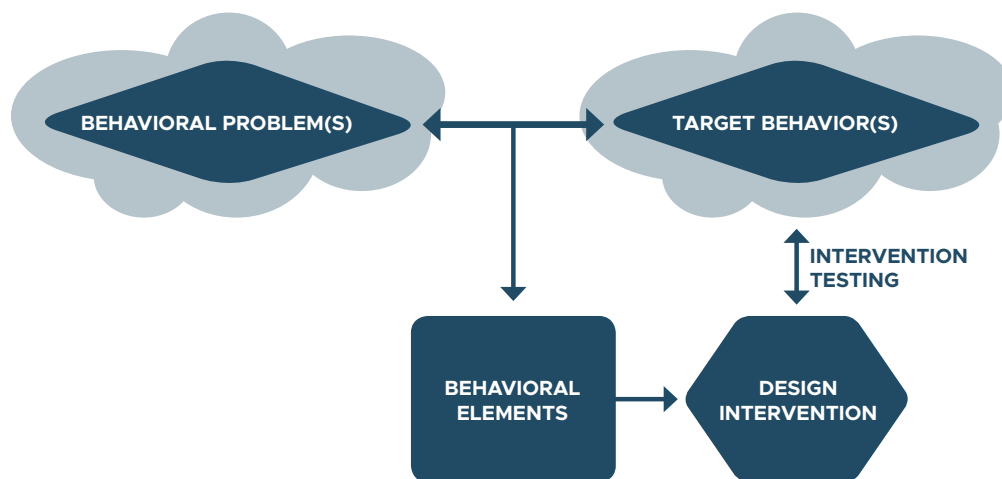


Figure 29 The key elements to define in the behavioral design process

Because of the general lack of behavioral definitions, it has proven challenging to present a cohesive outline of the different steps of the activities. Because of that, and to ensure comparability between cases and their behavioral problems, the well-recognized Fogg Behavioral Model (FBM) (B. J. Fogg 2009) is used to present the behavioral elements the entrepreneurs stated as behavioral challenges. In addition, the associated design intervention and test-measures are presented, as well as the target behavior and progression in behavioral problem definition. See Table 4.

Note, as the entrepreneurs did not apply a behavioral framework, it is the authors depiction of the entrepreneurs' descriptions of their utilized behavioral elements according to the FBM framework.

	Case 1	Case 2	Case 3	Case 4
Initial Behavioral problem	Movement during scan	Lack of treatment compliance	Lack of treatment compliance	(Undetectable) damaging of soft tissue
Scoped Behavioral Problem	Uncomfortable during scan	Uncomfortable during treatment (Stigmatized during treatment)	Not able to treat with treatment (set correct pressure) Stigmatized during treatment	Not able to manipulate soft tissue carefully
Target Behavior	Less movement during scan Be comfortable during treatment	Be comfortable during treatment	Able to assess pressure Find the design "cool"	Less demanding to handle soft tissue carefully
Behavioral Elements	Lack of motivation to not move, due to: <i>Uncomfortable to be scanned with rigid coils</i> <i>Boring /unsettling to be scanned (pediatric patients)</i>	Lack of motivation to comply to treatment, due to: <i>Uncomfortable to sit for the duration of the treatment</i> <i>Uncomfortable to look at the light</i> <i>(Stigma associated with the visual appearance of the treatment design)</i>	Lack of Motivation to comply to treatment, due to: <i>Stigma associated with the visual appearance of the treatment design</i> Lack of Motivation to comply to treatment, due to: <i>Does not have the ability to assess whether they are getting the right treatment regiment</i> <i>(Does not have the ability to pay the price of the treatment)</i>	Lack of ability to handle tissue carefully, due to: <i>Has limited ability to manipulate tissue without damaging it</i> <i>Ergonomically uncomfortable</i>
Design Intervention	- Less rigid coils - Playful pattern on coil	- Lying chair (- <undefined> less stigmatizing design)	- Provide value for pressure - Animal-inspired design (- Lower price)	- Less invasive manipulator technology - Ergonomically designed handle
Testing Measures	Movement during scan User or caregivers stated experience	User or caregivers stated experience	Able to assess pressure Users find the design "cool"	Suction-technology's pressure on tissue Users stated experience

Table 4 Key definition elements

First a short introduction to FBM is provided.

The FBM describes three things that need to come together for a behavior to occur; motivation, ability and trigger. A sufficient degree of motivation to perform the desired behavior must be matched with the sufficient abilities to do that behavior and must be triggered by a “call-to-action”.

In the FBM framework motivation consists of three elements; pleasure/pain, hope/fear, and social acceptance/rejection.

In the FBM framework ability is governed by what is referred to as “simplicity factors”. The notion of simplicity factors highlights the mindset that increasing ability is not about teaching or training of people, rather it is centered around making the behavior easier to do. The simplicity factors include; time, money, physical effort, brain cycles, social deviance, and non-routine.

Each person has a very different simplicity profile, while some have a lot of time to invest others have a lot of money, while some don't mind physical effort others don't mind deviating from social norms. Simplicity is also very context dependent. Fogg (2009a) defines simplicity as “s function of a person's scarcest resource at the moment a behavior is triggered”.

Finally, the third elements in FBM is the triggers, which ranges from prompts, cues to call-to-action, and so on, anything that tells people to begin performing a behavior. In the framework, three triggers are highlighted; spark, facilitator, and signal.

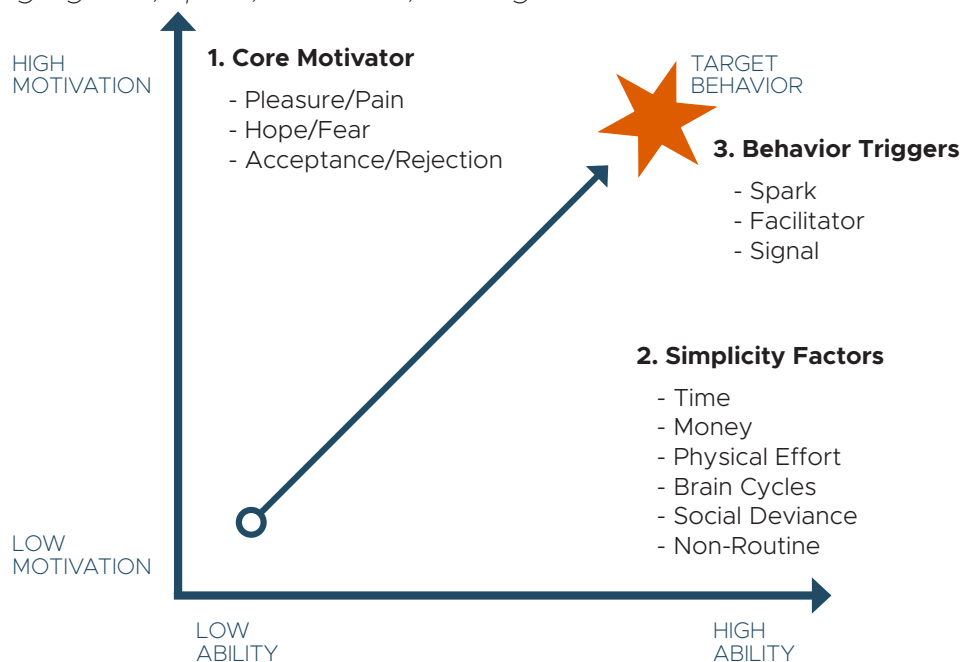


Figure 30 Fogg Behavior Model with subcomponents (B. J. Fogg 2009a)

The initial behavioral problem was ill-defined, such as “movement during scan” (case 1) or “*lack of treatment compliance*” (case 2 and 3). The entrepreneurs generally put a limited effort into defining the problem further, and while behavioral problem did get scoped somewhat beyond the initial definition, it could still be considered ill-defined.

The type of input the entrepreneurs would rely on to scope the behavioral problem, was based in the (limited) explorative work, but to a large extent also intuition, and for some (case 2 and 3) also personal experience, see Table 3.

For example, one entrepreneur (case 2.1), when asked how she identified “comfort” as an important issue, she explained that her own experience made it obvious:

“I can’t sit here all day, so you have to have like a leaning chair that’s kind of like nice and maybe have like either a light above them or if they’re doing something already like writing, um, that’s more comfortable for them. [...] I mean even yourself, right? If you sit at a chair, it was an uncomfortable chair. You don’t want to stay there for a long time. So just learning from your experiences.”

Following, the limited scoping of the behavioral problem, the entrepreneurs would have an ill-defined target behavior as well. The target behavior was fundamentally the inverse of the problem behavior. Since the problem behavior was ill-defined so was the target behavior. Additionally, the target behaviors were not measurable and thus difficult to test beyond a qualitative assessment. Which can be seen in table as the prevailing method. Both in terms of qualitatively asses for example “less movement” as well as assessing “comfort” through questionnaires of the users’ experience.

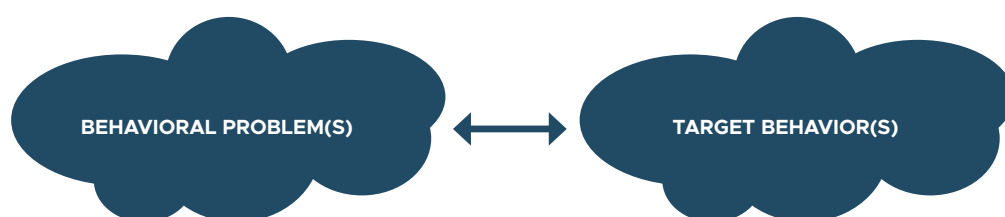


Figure 30 Ill-defined Behavioral Problem(s) & Target Behavior(s)

While for the author has provided an overview of the behavioral elements the entrepreneurs designed against. This had specifically not been done, or only been done to a limited extent, by the entrepreneurs. Rather the behavioral elements were co-evolved together with the design intervention, as the entrepreneur imagined design interventions based largely in intuition (see section 4.2.3 for more detail).

For example, one entrepreneur (case 3) had scoped stigma as a problem towards treatment compliance, but not defined the problem further. During the interview it became clear, that the entrepreneur had co-evolved the identification of the behavioral element; lack of motivation due to the unaesthetic visual appearance, together with the solution; a “cool” animal mask, to counter the stigma.

“So, we, we went, we really wanted to attack that problem because... not aesthetic. And everywhere you go you have people’s staring weird at you... like that will probably eat your mind. Like you will probably feel really bad about it. [...] So, we make like a pressure sensor mask that was maybe with like a fabric that was really cool, you can enhance like the mask, you can be a tiger. It’s always like we wanted to make something like really human. To make burn survivors feel like cool or cute, and when people saw them they would be like oh that is a really cool design.”

This approach meant that while the entrepreneurs intervened against specific behavioral elements, they only to a limited extent had an understanding of the elements that did not address or even what the remaining behavioral elements were, nor the nuances associated with them.

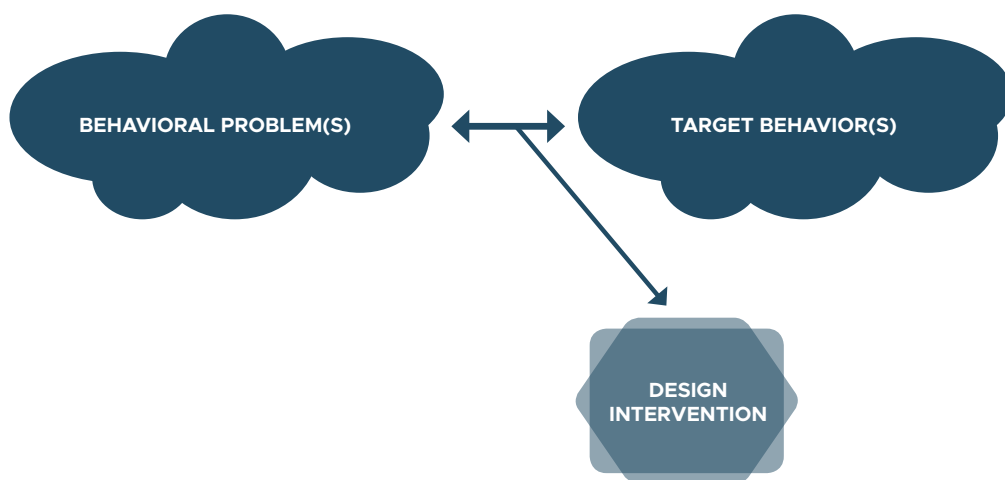


Figure 31 Limited definition and knowledge on Behavioral Elements

KEY FINDING: THE ENTREPRENEURS ENGAGED IN DEFINITION WORK TO A LIMITED EXTENT. AND THE PROBLEM BEHAVIOR REMAINED RATHER ILL-DEFINED RATHER THAN PROGRESSING TOWARDS ONE OR SEVERAL MORE CLEARLY SCOPED AND DEFINED PROBLEMS. LIKewise, DID THERE NOT GO A LOT OF WORK INTO DEFINING THE TARGET BEHAVIOR, THAT WAS RATHER THE INVERSE OF THE (ILL-DEFINED) PROBLEM BEHAVIOR, AND WITH NO QUANTIFIABLE MEASURES.

4.2.3 Design intervention development

The data show that the entrepreneurs relied heavily on intuition, existing solutions and, to some extent, their personal experiences to develop the design intervention, see Table 3.

For example, an entrepreneur (case 1) explained how he had based a design decision regarding the visual look of the coils on intuition. That aspect had subsequently become a big part of the design intervention:

“It came from a good intuition, which was we needed to create something that was resistant to weather any way around it, to protect it, and uh, and uh, we decided that if we were going to do something for children, resisting... we can might as well put something nice around it.”

Notably following the interview (after the tape-recorder was turned off), the entrepreneur explained he had been primed to the design idea from an existing design intervention, of a decorated MRI machine, that had proven successful in decreasing movement from pediatric patients undergoing MRI scan. Importantly, this was not an intended activity to explore existing successful solutions, rather it can be viewed as a contingency that the entrepreneur was aware of that solution.

KEY FINDING: THE ENTREPRENEURS RELIED HEAVILY ON INTUITION DURING THE DEVELOPMENT WORK. SOME ALSO RELIED ON PERSONAL EXPERIENCE OR EXISTING SUCCESSFUL SOLUTIONS.

4.2.4 Design intervention testing

The data show that the entrepreneurs generally relied on relatively frequent testing, which was also the case when assessing behavioral design interventions.

The main focus of the entrepreneurs' testing, was that the entire or most the product/system was tested jointly (see Table 3). As one entrepreneur (case 1) explained, he would have a partner test the product prototype in situ, and give overall feedback based on that:

“Um, the comfort [identified cause of behavioral problem], that's were, that's where we did. We actually kept giving every new generation of prototypes to our partner at Stanford. He's a pediatric radiologist and uses them on his patients. And he's scanned more than a hundred pediatric patients now and, and, and then gives us feedback every time.”

This can be views as well-aligned with the defined target behavior, that is loosely defined as “less movement during scans” (see Table 4),

rather than a more specific target behavior related to the behavioral elements. Thus, that is what the partner is testing.

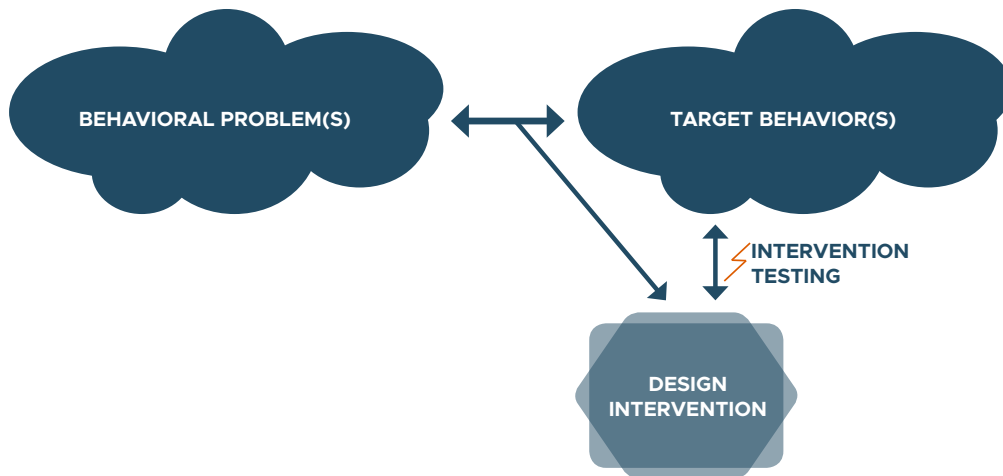


Figure 32 Intervention testing through joint quantitative testing and/or semi-single qualitative assessments.

However, the entrepreneur explained that the partner would gain knowledge specifically on the comfort from the users, through questionnaires regarding the users' attitude and preference:

“when he scans the patients, there is a questionnaire that they asked for the parents and the child what he thought.”

The latter example, of the entrepreneur using questionnaires to assess the behavioral design interventions was also characteristic for 3 of the 4 spin-outs, see Table 2.

KEY FINDING: THE ENTREPRENEURS RELIED ON JOINT QUALITATIVE TESTING OF THE ENTIRE OR MOST OF THE PRODUCT/SYSTEM TO TEST WHETHER THE (LOOSELY) DEFINED TARGET BEHAVIOR WAS MET. IN ADDITION, MOST OF THE ENTREPRENEURS ALSO RELIED ON SOMEWHAT MORE TARGETED QUALITATIVE ASSESSMENTS.

This sub-section has established that the respondents only use parts of the behavioral design process and do so based in intuition and available means.

5 DISCUSSION

This chapter compares the findings from the case study to the knowledge about behavioral design and effectuation established in the literature review. It examines the possible consequences of the approach and process adopted by the entrepreneurs in the case study.

5.1 The general approach

The findings showed that the entrepreneurs generally adhered to a process that was characterized by a focus on available means. Based on the means that were available to them, the entrepreneurs imagined possible activities and solutions originating from those means.

Generally, this type of approach is well aligned with effectuation that stresses a means-driven approach, as an effective way of dealing with the extreme uncertainty that entrepreneurial ventures face (Sarasvathy 2001).

Additionally, the findings show that the general process was characterized by very open-ended aspirations like “learning-experiences” (case 1, 2.2, 2.2, 4.1, and 4.2) and “making a difference in any way possible” (case 2.1, 2.2, 3, and 4.2). Open-ended aspirations like these are highlighted as nearly a prerequisite to engaging in the effectual process (Sarasvathy & Dew 2005). This is because the effectual process progresses through the commitment of stakeholders, who contribute additional means, but also additional constraints through new goals, which the process must be able to include, even if that means pivoting from previous imagined goals (Sarasvathy & Dew 2005).

The process approach assumed by the entrepreneurs is well aligned with effectuation. This suggests that the entrepreneurs have adopted a process that will allow them to be effective entrepreneurs, according to Sarasvathy (2001).

This is not necessarily surprising, as it was suggested in the literature review, that the spin-out entrepreneurs would presumably strive towards an effective entrepreneurial process. However, it was questionable how well the spin-out entrepreneurs would be able to adhere to the process, given their relatively recent encounter with entrepreneurship and thus near-novice state. This finding confirms that the spin-out entrepreneurs generally follow a means-driven approach despite their “non-expert” status. This could be due to the high concentration of entrepreneurial expertise in their environment enabling a faster adoption of the effectual reasoning. It could also be due to the entrepreneurial experience already accumulated by

the entrepreneurs, as most had been working on their spinouts for a while at the time of the case study, and some had previous start-up experience from other projects as well. While it is not the goal of this study to identify the source of the effectual approach among students, it is clear that this approach existed and that there could be a range of factors driving it.

Notably, the findings show that there were some instances where the entrepreneurs would engage in processes to address more clearly defined goals and would actively seek out the means to do so. Hence, activities that could be characterized as predominantly goal-driven, and is better aligned with a causal mode of reasoning, according to effectuation (Sarasvathy 2001).

These exceptions were especially centered around regulatory concerns, for example clinical trials and FDA approval. The entrepreneurs would still be wary of spending (too many) resources and their choices of means would, to a large extent, be based in what required the fewest resources on their part. Examples of this includes seeking out partners with ongoing clinical studies to get clinical data (case 2) or utilizing already FDA-approved materials for the medical device (case 4). However, all the spin-outs mentioned at some point during the interviews that they had, or would need to, venture out to gain means to comply with a regulatory approval goal. Some explicitly stated that they need, or probably would need, expensive regulatory consultants. The overall approach to the challenges was driven by a specific goal where the entrepreneur “chose between means to create a specific effect”. This mode of decision making is more aligned with causal reasoning than with effectual reasoning (Sarasvathy 2001).

From a strictly effectual mode of reasoning perspective, this is not well aligned with effectuation, as the entrepreneurs should rather utilize their means to create goals, and not seek out means to fit with a pre-defined goal (Sarasvathy 2015).

However, it is not necessarily misaligned with the overall framework of effectuation, as proposed by Sarasvathy (2001). As described in the literature review, Sarasvathy (2001) stresses that effectuation and causation are not dichotomous, although they are often juxtaposed for explanatory purposes. Instead, they are both part of human reasoning - which includes entrepreneurs' reasoning. Effectual reasoning is simply used to a higher extent among entrepreneurs, compared to non-entrepreneurs. Ergo, the inclusion of a more goal-driven process in itself not inherently misaligned with the framework of effectuation.

Additionally, Sarasvathy and Dew (2005) showed that there are times in the development of the start-up where the entrepreneur should rely more on causal reasoning (albeit usually late in the process, see

literature review in chapter 2).

The overall means-driven strategy adopted by the entrepreneurs, is not particularly well aligned with the behavioral design process. As explained in the literature study, the behavioral design process stresses a predominantly goal-driven approach, in order to effectively deal with the complex and very contextual nature of human behavior (e.g. Cash et al. 2017; Darnton 2008b). Furthermore, relying solely on the means readily available, which would often be the approach of the entrepreneurs, may prove problematic for a successful behavioral design process. Ultimately, specific activities need to be conducted to ensure an effective behavioral design process. Not conducting those activities in a way that is aligned with the behavioral design process, is a proven indicator of project failure (Cash et al. 2017). This suggests that the spin-outs are less equipped to address the behavioral concerns in an effective way.

However, the spin-outs did show an ability to adopt a more goal-driven approach at times. Such an approach is arguably more in line with behavioral design processes (e.g. Darnton 2008b; Cash et al. 2017).

Additionally, the reservations the entrepreneurs had about employing goal-driven strategies, were mainly related to resource scarcity and a concern that such a strategy would be too resource consuming. This concern can also be aligned with behavioral design. While the behavioral design process does prescribe specific methods and activities which makes it inherently resource-heavy, several methods for lowering the need for resources have been suggested. In particular limiting the scope of the design project (and the ambition), also limits the extent of the work required to untangle the complexity of human behavior (e.g. Cash et al. 2017; B. J. Fogg 2009b). Additionally, Fogg (2009) even explicitly encourages drawing heavily on existing solutions which have proven effective, for inspiration, in order to lower the required resources. Notably, this has to be accompanied with an equal limit in scope and considerations of differences and/or changes in national and global trends (B. J. Fogg 2009b; Cash et al. 2017).

SUB-CONCLUSION: The entrepreneurs followed an approach that is more in line with an effectual mode of reasoning than causal mode of reasoning. This approach typically indicate an effective entrepreneurial process and in-effective behavioral design process.

This suggest that the process adopted by the entrepreneurs, is well equipped to handle the entrepreneurial challenges, but less equipped to handle the behavioral challenges that the entrepreneurs face.

However, the entrepreneurs were also found to be using a goal-driven approach, albeit attempting to do so in a resource-light way. such a strategy is better aligned with engaging in an effective behavioral design process.

Following the discussion of the overall approach, the next step is to discuss the entrepreneurs' specific approach to dealing with behavioral challenges, in relation to effectuation and behavioral design.

5.2 Dealing with behavioral challenges

The findings show that the entrepreneurs' approach to addressing behavioral concerns was relatively similar across the different cases (see Table 3). They did follow some of the activities in the behavioral design process rather consistently, while others where consistently ignored.

Below, the characteristics of the overall approach to behavioral concerns specifically are examined, through the sub-stages of the behavioral design process described in the literature review; explorative work, definition activities, intervention development and intervention testing, see figure 33 below.

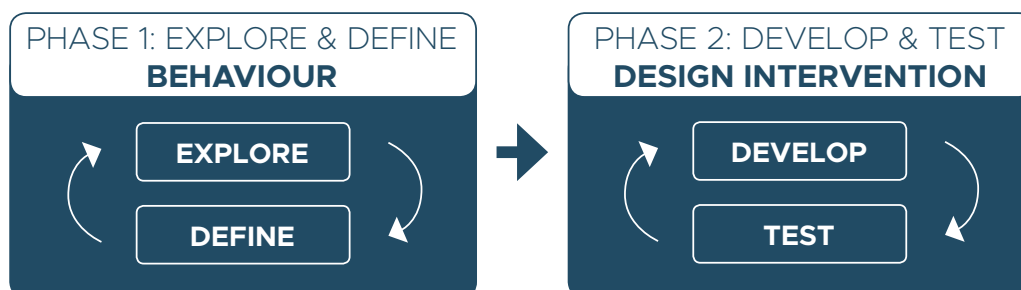


Figure 33 Outline of the behavioral design process elements

5.2.1 Explorative work

The findings show that the entrepreneurs did engage in explorative work to increase their understanding of the behavioral challenge. However, the entrepreneurs would typically engage in tangible and qualitative studies, that employed methods such as interviews or surveys, which exclusively yielded qualitative data around attitudes and preferences. In addition, the entrepreneurs had an extensive leniency with regards to the choice of study subjects based in perceived expertise and availability (see Table 3).

5.2.1.1 Study methodology

As described in literature review, qualitative, studies based on the users' preferences and attitudes, can certainly be part of the behavioral design process. However, while these insights can be important to understand intentions and motivation, they are explicitly not insights on actual behavior (Darnton 2008b; Cash et al. 2017). When asked rather than observed, users will often reveal espoused theories of how they would like to behave, rather than how they are actually behaving, which is why such data should not be assumed to reflect actual behavior.

In order to have an effective behavioral design process, designers should rely on data based in observations, that can generate measurable and testable hypothesis (B. J. Fogg 2009b; Cash et al. 2017).

In addition, as described in the literature review, tangible user studies can be an important part of the explorative work. In addition, tangible user studies during the explorative work can be a very important part of the subsequent interventions testing in the behavioral design process.

In the explorative work, tangible user studies can play an important role in extending understanding of theoretically established behavioral models and to provide increased understanding of contextual factors (e.g. Darnton n.d.; Cash et al. 2017). This of course pre-supposes an exploration of theoretical models in order to be effective.

In addition, tangible user studies from the explorative stage should play a very important role in regards to the subsequent design intervention testing in the form of testable hypothesis that the impact of the intervention can be measured against (e.g. Darnton n.d.; Cash et al. 2017).

However, the findings show that the entrepreneurs did not engage in theoretical explorative work that the tangible studies extended understanding of. Rather, the entrepreneurs used the tangible findings as well as intuition and personal experience to understand their respective behavioral challenges (see Table 3). From a behavioral design perspective, it is problematic to rely solely on tangible studies without theoretical supplement, as basing the behavioral models in thorough theoretical exploration and analysis is highlighted as one of

the key attributes of a successful behavioral design process (Cash et al. 2017; Michie et al. 2008). In fact, Cash et al. (2017) explicitly points to the inadequate developing of behavioral models prior to explorative tangible studies as a major issue in relation to unsuccessful behavioral design projects.

Additionally, the entrepreneurs would not establish testable hypotheses based on the tangible studies. This may be largely a result in the choice of qualitative studies explained above since qualitative data doesn't provide a good basis for developing such hypotheses (Cash et al. 2017).

In other words, while conducting tangible studies are an important part of behavioral design, the entrepreneurs largely failed to truly utilize the strength of the activity from a behavioral design perspective. Furthermore, the exclusive reliance of tangible studies is problematic.

Unlike behavioral design, effectuation does not prescribe specific activities to ensure an effective effectual process. Instead, effectuation encourages entrepreneurs to follow the effectual principles introduced in the literature review to deal with the extreme uncertainty facing entrepreneurial ventures (Saravathy 2008). According to effectuation, expert entrepreneurs always begin with their means, in the form of their personal traits, skills and network, and what they can actually do with their means (Saravathy 2015).

Hence, from an effectual perspective, the effectiveness of using this method is less based in the characteristics of the method itself, and more in how well those characteristics correspond to the means available to the entrepreneur and what the entrepreneur can do with those means. To assess whether the explorative method was applied in a way that is effective according to effectuation, a comparison to the means available to the entrepreneurs must be conducted.

Comparing the means of the entrepreneurs to the choice of qualitative interview/survey method, it can be noted that 5 out of 6 highlighted their ability to "talk to people" as a major part of their personal traits. However, none of the entrepreneurs had formal training in either qualitative interview, survey design or application. Meanwhile, at least 4 out of the 6 entrepreneurs had training and experience in quantitative experimental testing through their educational background, including rather extensive experience for some. This experience and associated skills would arguably be more relevant for quantitative rather than qualitative studies. Therefore, quantitative testing is arguably well within the means of most of the entrepreneurs. Although this experience was not specifically in testing of behavior, it is fair to say that quantitative testing was generally more within the means of the entrepreneurs than qualitative.

From an effectuation perspective, it is striking that most of the entrepreneurs chose to utilize a method which was arguably less

within their means, since effectuation promotes the use of methods and activities within the entrepreneurs immediate means (Sarasvathy 2001).

A similarly interesting observation is found in the entrepreneurs' choice of tangible rather than theoretical work, when compared to the means available to the entrepreneur. This is again a striking choice from an effectual perspective, as the entrepreneurs have significant means within academia and applying theoretical knowledge. Most notably, all of the entrepreneurs had quite an extensive academic educational background; all had degrees at or above master's degrees; 2 had obtained PhDs and one a medical doctorate degree. Furthermore, the entrepreneurs themselves highlighted their skills within the use of academic research sources, even outside their immediate knowledge corridor, as shown in the findings-section. It is therefore quite clear that applying theoretical knowledge in the explorative work would be within the means of the entrepreneur and appropriate from an effectual perspective.

Interestingly, the entrepreneurs expressed confidence in their choice of method, and their ability to conduct the studies and surveys. As one entrepreneur (case 2.1) explained, when asked how to get data on the behavioral concern her spin-out faced:

“Oh, that’s kind of simple. We kinda just had a prototype and then we went around to people who are older, just older people, not necessarily like Alzheimer’s patient because you do, you do know that when they get older they have some similar kind of regression of their eyes, some discomfort or the body and sitting wise and uh, and just put it in front of them and we took it to different facilities and home and ask them, oh, what do you, how do you think it looks?”

This suggests that the entrepreneurs may be unaware of the characteristic of sound behavioral data. And it may suggest the fact the spin-out entrepreneurs chose not to utilize their skills within theoretical exploration, could stem from a lack of knowledge about the value of theoretical knowledge in behavioral design processes.

SUB-CONCLUSION: while the entrepreneurs did engage in explorative work as prescribed by the behavioral design process, they did so in a way that largely failed to address the distinct challenges of dealing with behavior; namely the complexity and context-dependent nature of it. This suggests that the entrepreneurs did not truly gain the understanding of the behavior to engage in an effective behavioral design process, thus effectively addressing behavioral concerns. Furthermore, while the entrepreneurs did utilize their immediate means, hence principally being in line with effectuation, there were also immediate and valuable means which were ignored. A closer examination of the entrepreneurs choices shows several examples where means with a stronger link to the entrepreneurs core skills were ignored, in favor of skills with a weaker link. The entrepreneurs confidence in their chosen method, suggests that they were unaware of the characteristic of sound behavioral data. Ultimately, the chosen methods toward explorative work was arguably not particular appropriate from neither a behavioral design perspective nor an effectuation perspective.

5.2.1.2 Choice of study- and test subjects

The findings show that the entrepreneurs based their choice of study- and test-subjects largely on the same parameters. Therefore, study-subject identification and test-subject identification will be treated jointly in the following:

Identification of study- and test subjects were largely based on availability. Sometimes this would yield study- and test-subjects within the intended user-population. One example is case 4, which had access to the intended user-population (surgeons), primarily through one of their founders. Another example is case 1, which was able to do in-situ testing of the design intervention through a partner. Other times, however, that approach did not yield study- or test-subjects within the intended user population. For example, one entrepreneur (case 3) planned to do an explorative study with parents of burn victims in Chile, who, according to his own account, were more accessible for him, instead of the intended users; parents of burn victims in the United States. Another entrepreneur (case 2.1) explained that she would be satisfied with test subjects that were cognitively impaired to a larger extent than the intended users, thus effectively risking testing on subjects with a different cognition than the intended user population.

Both examples are evidence of the use of rather extensive leniency

with regards to finding appropriate study- and test-subjects subjects. It seems the question of easily available study- and test subject, preferable within the entrepreneurs' immediate network, plays a major role.

From a behavioral design perspective, not testing on intended users is very problematic. In behavioral design, the purpose of doing tangible explorative work is getting specific contextual data (to compliment the theory-based behavioral model) (e.g. Darnton n.d.; Cash et al. 2017). As it was established in the literature review, one of the key attributes of behavioral design is that it is highly context-dependent. Hence, venturing outside the intended context is very likely to yield behavioral data that does not reflect the intended context but rather the context examined.

For example, gaining insights from Chilean parents on stigmatization and treatment adherence of burn survivors, will yield contextual data related to those issues on the behavior of that population, and not the intended population; parents to burn survivors in the United States.

That being said, it is conceivable that both populations in the example above, share some global contextual factors as e.g. "parents" or "caregivers". Hence, this population may serve as a proxy population in uncovering uncertainties related to some of these contextual factors. However, that approach would inherently be engulfed with a lot of uncertainty, and it would require thorough definition and separation of different elements of the behavioral problem(s), target behavior(s) and/or design intervention.

In addition, the findings show that there was a tendency to rely on clinical experts, rather than actual users. The findings showed that this choice was partly due to availability, but also to an assumption that these experts could convey the needed information more efficiently and/or more accurately than actual users.

The second assumption, that clinical experts have more knowledge and/or more accurate knowledge on the behavior of specific users than the users themselves can convey, is problematic from a behavioral design perspective: Even though there is definitely a lot of value in speaking with these experts, it is not the same as studying actual user behavior. This issue appears to be very similar to the issue discussed in the previous sub-section 5.2.1.1, namely misalignment between perceived valuable data in relation to behavior and actual valuable data in relation to behavior. Notably, the clinical experts cannot be considered experts of their patients' behavior, albeit they may have valuable insights into more general trends.

In addition, the underlying problem is very similar to the problem with studying non-intended or "proxy" users, namely that they are both non-users and does thus not give data on actual use. Therefore, the

use of clinical experts instead of actual users, will be treated jointly with the choice of other non-users in the following. As with the proxy-user approach, this approach would require a thorough definition and separation of different elements of the behavioral problem(s), target behavior(s) and/or design intervention upfront, in order to be useful.

As the findings show, and which will be discussed in the next sub-section, the spin-out entrepreneur did not engage in thorough definition and separation of different elements of the behavioral problem(s), target behavior(s) and/or design intervention. Instead of thorough definition, the entrepreneurs would base the explorative studies and subsequent intervention testing on very high-level objectives. This suggests that they would not be able recognize the limitations of the contextual data from the proxy users. And by venturing outside of the intended context on that basis, the entrepreneur does not utilize the strength of this activity and will, at best, fail to capture the value in the activity in relation to behavioral concerns. Worse yet, the entrepreneur may not merely get inadequate data, but misleading data, as the contextual differences may be decisive. In case 3, for example, it is conceivable that Chilean parents will behave differently in response to different price-points. As a basis for determining at what price-point the treatment would be available to the target population and thereby allowing them to change their behavior and comply to the treatment, this data might therefore not only be useless, but directly harmful.

It is clear that this strategy, and the way it is applied, is in conflict with the behavioral design process. However, upon closer analysis, the approach does not reflect a good effectual process, either. Based on the knowledge that the data from this strategy is likely to be useless or directly harmful, it is arguably also mis-aligned with the theory of effectuation.

Effectuation does promote techniques that are inherently less certain in their predictions of the outcome. For example, the effectual principle of affordable loss promotes committing to what one is willing to loose, rather than what can be expected to yield the greatest return (Sarasvathy 2008). However, this should not be mistaken with effectuation suggesting that any task, even useless or harmful ones as in this case, that require few resources, is effective. In contrast, effectuation promotes the use of few resources, not for the sake of just doing something/anything, but rather to uncover extreme uncertainties in an effective way. As Sarasvathy (2001) explains:

“Effectuation presupposes how much loss is affordable and focuses on experimenting with as many strategies as possible with the given limited means.”

This builds on the premise the activities undertaken goes toward uncovering uncertainties. Activities that do not go towards uncovering

uncertainties are not useful and are arguably not aligned with effectuation. This is regardless of whether they require few resources and are therefore within affordable loss or other effectual heuristics.

Importantly, in both effectuation and behavioral design the invalidation of assumptions is not considered useless data, rather it is considered a (important) part of the process. Hence, useless data in both frameworks (and this thesis) is data that neither validate nor invalidate assumptions/hypothesis.

While it has been established that the entrepreneurs approach was arguably not in line with the overall of framework of effectuation, it is understandable how the entrepreneurs might think that it was. Someone that does not know why and to which extent the data yielded by such an approach is useless/harmful, might intuitively assume that the approach is following the principles of effectuation. Utilizing subjects either within, or closely associated with, one's immediate network, rather than spending more resources by venturing out to find the most appropriate subjects, may intuitively feel better aligned with the means-based approach of effectuation as well as effectual principles such as affordable loss. However, this is a misinterpretation most likely caused by lack of knowledge of the consequences of that strategy.

The consistency with which the entrepreneurs did utilize this strategy, suggests that these consequences were not known to them. They appear to have been unaware of the prerequisites for sound behavioral data, as was also the case in the previous discussion in section 5.2.1.1 regarding the explorative methods.

This finding represents an intersection between effectuation and behavioral design, which makes it particularly interesting for this study. It suggests that finding study- and test-subjects for a behavioral design process, may be a good example of an instance where the use of an effectual mode of reasoning is not effective within the overall theory of effectuation. As touched upon in the literature review and in the previous section 5.1, effective entrepreneurs rely on both effectual and causal modes of reasoning within the theory of effectuation. Relying solely on effectual reasoning, would actually go against the overall framework of effectuation as a best-practice approach to the entrepreneurial process. While effectual reasoning should be the dominant mode of decision making in the initial stages, it is sometimes necessary to employ causal reasoning instead. This study indicates that the identification of study- and test-subjects is a good example of such a situation. Due to the specific demands towards usable study- and test subjects in a behavioral design approach, the findings in this thesis suggest that this cannot be successfully obtained with a purely effectual mode of reasoning.

Notably, the difficulty of obtaining appropriate subjects is to some

extent recognized in behavioral design. For example, it has been suggested that the initial scoping of the project be based in available target population, and expanded subsequent to developing a (successful) design intervention (B. J. Fogg 2009b; Darnton 2008a). This is well aligned with effectuation, that recognizes pivoting according to available means a major aspect of the effectual process (Sarasvathy & Dew 2005). This indicates that the behavioral design field is developing ways of mitigating the conflict between the behavioral design process and effectual reasoning in this area. However, this was not applied in the any of the cases described.

SUB-CONCLUSION: The entrepreneurs utilized contingencies and their closely related network to find study- and test-subjects, which sometimes led to subjects being non-users. This approach is mis-aligned with behavioral design, which suggests that such an approach would yield data that lacked relevance and might even be misleading. This makes the approach inherently mis-aligned with effectuation, which does not promote the use of time and resources on activities that does not shed light on the uncertainties that face the entrepreneurial venture. This suggest that the activity of finding study- and test-subjects for a behavioral design process may be an instance where effective entrepreneurs should rather rely on a more causal mode of reasoning.

5.2.2 Defining activities

The findings show that the entrepreneurs started out with very vague definitions of their behavioral problems, such as “lack of treatment compliance” (case 2 and 3) or “movement during scan” (case 1). As the literature review showed, this is not surprising, as it is in fact characteristic of design processes. Yet, as presented in the literature review, the overall design process goes toward turning the ill-defined problem into a well-defined solution. In the behavioral design process in particular, this requires an early and continuous effort to define behavioral problems, target behavior and behavioral elements, to be able to navigate the complex nature of human behavior.

However, the findings show that the entrepreneurs did not define the behavioral problem much beyond the initial ill-defined problem, and the subsequent definitions were still characterized by being quite vague. For example, “uncomfortable during treatment” (case 2) or “stigmatized during treatment” (case 3).

In addition, the associated target behavior was typically equally

vaguely defined, e.g. “be comfortable during treatment” (case 2). More importantly, the behavioral problem and associated target behavior had not been quantified (refer to the lack of quantitative studies described above). As a result, determining when the target behavior had been met, was a purely qualitative assessment (see section 5.2.4).

From a behavioral design perspective, the lack of definition across the process is very problematic, as the complex and context-dependent nature of human behavior requires an early and continuous effort to define relevant elements in order to address them effectively (e.g. B. J. Fogg 2009b; Cash et al. 2017; Darnton 2008b). In addition, doing so both theoretically and tangibly, has proven extremely important and a major indicator of project success (Cash et al. 2017).

The failure to properly define, affects the rest of the process negatively, as the behavioral designer is not able to properly identify important behavioral elements, change strategy, etc. Ultimately, the entrepreneur will be unable to properly assess whether the target behavior have been met and/or what contributed to an observed behavior change. This have proven to result in both poor project outcome and re-work (Cash et al. 2017).

From an effectual perspective, the lack of constraints (as imposed by definitions) is typically a positive thing. The lack of constraints allow the entrepreneur to pivot according to contingencies, as well as to partner with people with additional means, in return for allowing those people to impose influence through constraints (Sarasvathy & Dew 2005). This practically makes the lack of constraints a currency for entrepreneurs to gain additional means. Hence, from an effectual perspective, (excessive) definition activity can be very costly in terms of the ability to remain open to new means, and thus problematic. Therefore, it may intuitively seem like it is well aligned with effectuation to greatly limit the definition of the solution to the behavioral challenges.

However, as established above, not defining the work related to behavioral challenges adequately has such a poor outcome, that it, like the in the previous sub-section, 5.2.1.2, is arguably not well aligned with effectuation. Since the lack of definition will most likely render the entrepreneur unable to properly develop a design intervention and assess when the target behavior has been met, it makes the process inefficient in terms of uncovering uncertainties in this regard. While limiting definition is in line with some of the effectual principles, it is therefore not aligned with effectuations overall goal of uncovering the uncertainty facing the venture. This suggest that the activities related to definition in the behavioral design process is another instance where an effective effectual entrepreneur should rely on a more causal mode of reasoning.

Moreover, the spin-out entrepreneurs would arguably not have to

impose many additional constraints beyond what they have already, more or less consciously, constrained the process with. For example, all the spin-outs already had a rather constrained target population (as described in the previous sub-section), a relatively constrained problem (although not well-defined), and (what appeared to be quite unknowingly) constrained behavioral elements they worked with. Constraints-wise, it does not appear to be a big leap towards properly defining these elements. However, to do so may also be time-consuming, which, as described previously, makes it less aligned with other effectual principles, such as affordable loss.

SUB-CONCLUSION: the entrepreneurs only engaged in definition activities to a limited extent. It is poorly aligned with the behavioral design process, which shows a correlation between poor definition activities and poor project outcome and/or re-work.

From an effectual perspective, a lack of definition can be desirable, as it limits constraints and thereby preserves more flexibility to attract new means and pivot the start-up, if necessary. However, the correlated poor outcome towards the remainder of the activities related to behavioral concerns, makes the strategy poorly aligned with the overall theory of effectuation. This echoes the findings in the previous sub-section in that it suggests, that the activity of defining aspects related to behavior may be an instance where an effective entrepreneur should rather rely on a more causal mode of reasoning.

5.2.3 Design intervention development

The findings show that during the design intervention development, the entrepreneurs would rely on intuition. One case (case 2) would additionally rely on personal experience, and two cases (case 1 and 4) would additionally rely on existing (proven) solutions.

In the behavioral design process, the (continued) use of theoretical models to appropriate development paths is highlighted as a key determining factor for project success (Darnton 2008b; Cash et al. 2017; B. J. Fogg 2009a). Because of the complex and context-dependent nature of human behavior, relying on intuition to understand behavior is very difficult. It is likewise difficult to intuitively design for behavior (change). The fact that the entrepreneurs relied on intuition and personal experience, rather than theoretical frameworks, is therefore problematic from a behavioral design perspective. It suggests that the design intervention they have developed, or are about to develop, will most likely not be successful in changing behavior.

However, the two cases that relied on existing solutions, are to some extent aligned with behavioral design. For example, do Fogg (2009) propose the use of proven successful solutions. This can be especially useful as a “shortcut” for projects with limited resources such as start-ups, a category the spin-outs most definitely fall under. Importantly, using this method will not negate the explore or define work needed in the previous phase, nor should it be considered a simple “copy-paste” exercise. It should rather be viewed as an indication of what has a high likelihood of working. As Fogg (2009) puts it; the “secret sauce” of what makes the intervention useful must be identified. It must subsequently be fitted within the context of the specific intervention in question, and finally tested iteratively, to ensure it measures against the target behavior (Cash et al. 2017). Importantly, neither was done in these cases, which suggest that these adaptations of existing solutions are likely not successful.

For example, the re-use of playful patterns with MRI equipment by case 1, is a good example of utilizing proven solutions. However, the inclusion of that intervention was not particularly planned, nor has it been confirmed that the intervention has in fact led to the target behavior, i.e. “less movement during scan”.

As explained above, effectuation does not prescribe particular activities or methods. Therefore, the specific use of intuition and personal experience is not inherently better or worse in effectuation. The question is rather how well aligned the chosen method is with the means available to the entrepreneur (Sarasvathy 2001).

Intuition and personal experience is arguably at the core of one’s means, and conceivably require little in terms of time and other resources. In contrast, none of the entrepreneurs had working knowledge of behavioral theoretical frameworks. Although it has been shown that the entrepreneurs did possess the skills to obtain such knowledge, that would probably require a substantial investment in terms of time. Based on that, it principally makes sense from an effectuation perspective to base the development of the design intervention on more readily available means.

However, this argument can be made for almost every task the entrepreneur engages in. It does not necessarily mean that the theory of effectuation suggest that the entrepreneur should rely solely on intuition and personal experience. As was argued earlier, the theory of effectuation does not suggest to simply engage in activities which requires fewest resources, regardless of what quality comes out of it. Rather, it proposes to uncover uncertainties effectively in the face of extreme uncertainty (Sarasvathy 2001).

Still, this method, as opposed to the previous sub-section, 5.1.2 and 5.2.2, does in fact uncover relevant uncertainties to the extent that the

intervention is (frequently) tested. If tested frequently (and correctly), at least the entrepreneur will know what does not work.

A good analogy for this method of rather arbitrary trial-and-error is perhaps the idiom that appear to surface a lot in the start-up community; “throwing spaghetti at the wall and see what sticks”, that refer to using trial-and-error methodology to identify what works. While this method arguably works in other situations, it can be considered very in-efficient in determining a successful design-intervention.

First, as described above, due to the complex nature of human behavior it is quite unlikely to yield a successful result.

Second, should a successful intervention be created, the method will most likely not enable the entrepreneur to know how and why that intervention worked, which makes it difficult to scale or modify the intervention in any way.

Moreover, a proven method to increase the likelihood for anything “to stick” i.e. creating a successful intervention, and understanding why it is successful, is relatively accessible for the spin-out entrepreneurs, given their means available established earlier.

In this light it may be argued that the use of theoretical behavioral frameworks is a more resource efficient approach on the long-term and even on the relative short-term. Depending on the costs of determining what “sticks” i.e. the costs of testing the intervention. Therefore, depending on the context of the spin-out, it will typically be more in line with effectuation to adhere to the principles of behavioral design and utilize existing theoretical frameworks, to make more educated “spaghetti throws” instead of relying on intuition and/or personal experience.

Furthermore, the re-use of existing solutions, given it requires less resources, may be an even more and/or more frequently compelling route from an effectual perspective, even though (if done correctly) it still requires more resources than purely intuition and/or personal experiences.

Notably, as will be elaborated on in the following sub-section, due to the complex nature of behavior, the design interventions created by effective behavioral designers are, in essence, also “spaghetti throws”, although very educated ones. This is why frequent intervention testing is a key aspect of effective behavioral design.

SUB-CONCLUSION: The entrepreneurs would typically use intuition to develop the design intervention. This is poorly aligned with behavioral design, which specifically promotes the use of theoretical frameworks due to the complex and context-dependent nature of human behavior.

The use of a more readily available mean in the form of intuition, as opposed to the less readily available means of theoretical frameworks, may be in line with the effectual mode of reasoning. However, it can be questioned whether this is always well aligned with the overall theory of effectuation, as it will probably be less resource-efficient in the long run.

Notably, the re-use of existing solutions are in line with behavioral design, and arguably better aligned with effectuation as it often will require fewer upfront resources. However, the behavioral design framework would require a more structured approach to utilizing existing solutions than shown in the cases.

5.2.4 Design Intervention testing

The question of intervention testing is closely related to the previous discussion regarding explorative work (sub-section 5.2.1) and definition (sub-section 5.2.2). In addition, the issue related to the choice of test-subjects has been discussed in sub-section 5.2.1.2 and will not be discussed further in this sub-section.

The findings show that the entrepreneurs did engage in testing of their respective design interventions. The entrepreneurs would engage testing that can be categorized into two types of testing; joint quantitative testing and semi-single qualitative assessments as presented in the findings.

All the entrepreneurs had conducted (or planned to conduct) studies that included observation of use, referred to here as quantitative testing. However, the entrepreneurs expressed that the reason for engaging in those tests, was not to test specific hypotheses related to behavior. Instead, the goal was to conduct a joint holistic test of the whole product/system against a target behavior more closely related to the initial loosely defined problem, for example “more comfortable”. When asked how to assess the specific behavioral goal, e.g. “more comfortable”, the entrepreneurs typically answered that they had or “probably would” compliment the test with a survey.

The notion of (frequent) “real-world” testing is a key aspect of both effectuation and behavioral design. Effectuation emphasizes the importance as part of the overall notion of not relying on theorized

predictions of future outcome, but rather on controllable elements (Sarasvathy 2001). As discussed earlier, effectuation does not prescribe specific activities. However, the idea of real-world testing is arguably a necessary consequence of the above.

In behavioral design, the underlying logic is very similar. While much of the process in behavioral design is arguably centered on enabling the behavioral designer to make well-informed decisions regarding the behavioral design intervention, it will essentially always be conjecture. This is especially due to the complex and contextual nature of human behavior. In other words, regardless of how well the stages leading up to the design intervention were executed, the designer cannot know upfront whether the design intervention will work as intended. This notion bears resemblance to effectuation's assumption of the future being fundamentally uncertain. Because of this, the designer must engage in thorough testing to be effective in developing an impactful design intervention (e.g. Cash et al. 2017; B. Fogg 2009). However, in contrast to effectuation, the behavioral design process *does* prescribe specific activities. Moreover, these activities are closely linked to the work associated with the previous stages, which had largely proven in-effective.

First, from a behavioral design perspective, the entrepreneurs' approach to semi-single qualitative assessments has many of the same shortcomings as the qualitative and tangible explorative work discussed earlier; namely that such an approach mostly does not yield insights into actual behavior. To the extent that it does, it will rarely enable a measurable assessment of progress and impact. Furthermore, it is a key aspect of behavioral design to first iteratively test the design intervention(s) separately, before testing them with the whole product/system solution in a joint test (Cash et al. 2017). Otherwise, it is difficult to determine the impact of different elements, especially due to the complex nature of human behavior. This suggests that the quantitative joint assessments are not particularly effective either.

From an effectuation perspective, the idea of testing is arguably closely linked to the goal of not relying on theorized predictions of future outcome and instead focus on controllable elements (Sarasvathy 2001). From this perspective, it is vital that the act of testing allows the entrepreneur to get beyond theorizing and actually validate/in-validate the uncertainties that are tested for. The fact that the chosen test-methods does that to a very limited degree, according to behavioral design, seriously questions whether the activity lives up the intention – both from a behavioral design perspective and an effectuation perspective.

SUB-CONCLUSION: the entrepreneurs did engage in testing of the design intervention, which is aligned with both effectuation and behavioral design. However, they would do so in a way that does not effectively test the intervention according to behavioral design, thus largely negating the purpose of testing, both from a behavioral design and effectuation perspective.

6 CONCLUSION

In answering the research question; *what challenges do MedTech spin-outs face when addressing behavioral challenges?* it was established that the MedTech spin-outs would have to manage two distinct processes in parallel: a process that allowed them to be effective entrepreneurs, as well as a process that allowed them to be effective at addressing behavioral challenges.

Effectuation was established as a good framework for the type of process the spin-outs would have to follow in order to be effective entrepreneurs. Behavioral Design was established the relevant process for effectively dealing with behavioral challenges.

A review of current literature on effectuation and behavioral design subsequently revealed several conflicts between these processes. On one hand, effectuation emphasized the need for an effectual mode of reasoning and a nimble process, to effectively deal with the extreme uncertainties facing the entrepreneur. On the other hand, behavioral design stressed the need for a well-planned process that follows specific stages and activities in sequence and reflects a more causal mode of reasoning, in order to deal with the complex nature of human behavior. However, it was found that very limited research exists on how MedTech spin-outs navigated those conflicting demands in practice. A multiple case study was chosen as the preferred method for investigating the phenomena further. Through semi-structured interviews, data was collected from 6 respondents, representing 4 spin-outs within MedTech, facing behavioral concerns.

Findings from the study confirmed the existence of the potential conflicts between effectuation and behavioral design identified in the literature review. However, further exploration showed that the spin-out entrepreneurs navigated these conflicts in a way that was largely in-effective, both from a behavioral design and an effectuation perspective.

Firstly, the findings showed that the MedTech spin-outs' process was predominantly means-driven, with open-ended aspirations. This type of process is well aligned with an effectual mode of reasoning. Indeed, the study found that effectuation was the dominant mode of decision making for the entrepreneurs. This indicated that the entrepreneurs had adopted effectuation, which was established as an effective entrepreneurial strategy. In general, they could therefore be seen as effective entrepreneurs, according to the definitions used in this study.

However, an effectual mode of reasoning is often not well aligned with behavioral design which, in contrast, emphasizes a goal-driv-

an approach with specific activities and stages to be followed in sequence. This suggests that the spin-out entrepreneurs are in-effective behavioral designers. As their approach to addressing behavioral concerns was examined, this notion was further substantiated. The entrepreneurs had adopted a strategy that was less appropriate for an effective behavioral design process.

Overall, the findings suggest that the entrepreneurs attempted to navigate the conflicting demands of the behavioral design- and entrepreneurial processes, by applying an effectual mode of reasoning to addressing the behavioral challenges. This was well aligned with how they would typically operate. However, this approach was found to be in-effective both from the perspective of behavioral design and effectuation.

From a behavioral design perspective, a closer examination of the entrepreneurs' approach revealed that they did employ some of the elements in the behavioral design process, while others were consistently ignored. The elements that were employed, were done so in a way that was very in-effective from a behavioral design perspective. In general, the entrepreneurs approach to their respective behavioral challenges can be considered in-effective from a behavioral design perspective.

From an effectuation perspective, further exploration revealed that the entrepreneurs sometimes adhered to effectual reasoning, even in situation where it was not appropriate. In other instances, the entrepreneurs avoided effectual reasoning, in situations where it would have been appropriate. This yielded a process that can be considered in-effective within the overall framework of effectuation.

First, there were activities where the spin-out entrepreneurs ignored means with a stronger link to their core skills, in favor of skills with a weaker link, which is not well aligned with neither an effectual mode of reasoning nor the overall framework of effectuation.

Conversely, there were activities where the entrepreneurs did choose means closer to their core skills, but where other means would have been much more effective. So much so, that employing the closer means was found to be against the overall framework of effectuation.

Finally, there were activities that would only shed light on uncertainties to a very limited extent, if a purely effectual mode of reasoning was used. This suggests that those activities are instances where an entrepreneur should rely on a more causal mode of reasoning, to effectively uncover uncertainties and follow the overall framework of effectuation.

It was noted that the entrepreneurs appeared to be unaware of and/

or held misconception about sound behavioral data and the effective process for addressing behavioral concerns. It was also found that the entrepreneurs had, in other instances, been able to employ more causal modes of reasoning to complement the dominant effectual approach.

Based on these findings from the literature review and the multiple case study, the research question can be answered:

Overall, the MedTech spin-outs face a challenge in navigating the conflicting demands of an effective entrepreneurial process and an effective process for addressing behavioral challenges. There are three underlying obstacles, namely 1) recognizing relevant means, 2) understanding what data is appropriate and 3) determining when to shift between effectual and causal reasoning.

First, the spin-out entrepreneurs face the challenge of understanding what means are appropriate for an effective behavioral design process. Without this knowledge, the entrepreneurs cannot know which of their means to leverage and prioritize in the process. According to effectuation, the spin-outs actually have an advantageous starting point for engaging in an effective behavioral design process. They inhabit the skills to conduct one of the most important activities in behavioral design; exploring and utilizing existing theoretical frameworks. Even if behavioral theory it is not within their immediate knowledge corridor, their extensive experience in applying theoretical knowledge within academia is arguably a good resource-foundation for those activities. However, the spinouts in the study had not obtained this knowledge and were often unable to recognize relevant means.

Second, the spin-out entrepreneurs struggled to recognize when applying an effectual mode of reasoning to the behavioral design activities yields unusable data. Without this understanding, the spinouts risk obtaining data that is useless or even misleading. Activities yielding such data are not aligned with the effectual framework. However, activities that might yield less effective, but still usable data that goes towards uncovering uncertainties, are within effectuation. Some methods have been proposed for lowering the resources needed in the behavioral design process. This brings the process in better accordance with effectuation. However, these methods have to be combined with appropriate actions. Methods that could lower the resource demand of behavioral design and thereby make the process better aligned with effectuation include: defining the behavioral design project more narrowly, complementing available non-users with theoretical insights, and complementing existing, proven, design interventions with appropriate contextual insights.

Finally, it can be argued that the spin-out entrepreneurs face the chal-

length of determining whether it makes sense to commit to a process, that requires them to assume a predominantly causal mode of reasoning. While an effective entrepreneurial process is based primarily on an effectual mode of reasoning, it may be necessary to engage in tasks that require a more causal mode of reasoning. As has been shown in this thesis, the behavioral design process contains several such tasks. It is not a viable solution to engage in such processes using an effectual mode of reasoning, as this is not an effective approach to dealing with behavioral challenges. Instead, the solution might be found in another core element of the theory of effectuation; that entrepreneurs should focus on the things that they can actually do, instead of the things that they ought to do. In other words, they should abandon those activities and aspirations that require activities which the entrepreneur cannot do. From this perspective, it is worth questioning whether the university spin-out should address the behavioral challenges at all, or instead seek options that do not involve such concerns. They may be able to create an effectual artefact and experience a commercial success without doing so.

However, the evidence from this thesis supports a different conclusion. The methods and activities related to addressing the behavioral challenges effectively, are arguably very much within what the spin-out entrepreneurs can do. They are highly adept at putting theoretical knowledge into action, even when the knowledge has to be obtained outside their immediate knowledge corridor. This ability has been demonstrated repeatedly by the entrepreneurs, through their academic achievements. They have also all shown the ability to assume a more causal mode of reasoning. For example, they all apply causation to engage in or plan their regulatory process, which is arguably much further from what they can do, from a means-at-hand perspective. Even more importantly, the theory of effectuation puts great emphasis on the role of the entrepreneurs' aspirations as what guides the entrepreneurial process. Most of the spin-out entrepreneurs mentioned an aspiration along the lines of "making a difference". Not addressing behavioral concerns, would very likely compromise such aspirations, by limiting the impact of their technical discovery and the potential it has toward contributing the UN global goal and making a difference. As one entrepreneur (case 2.2) explained:

"[...]and the context has to be right for them to use it correctly. So that's extremely important. You could have the most beautiful, you know, the most beautiful product with the best software. Everything. Very expensive. But sell it very cheaply, and you're a good guy, but they don't use it correctly. Then it doesn't matter at all."

These results provide a novel perspective on the intersection between entrepreneurship and behavioral design. This has enabled an improved understanding and a better definition of the challenges faced by the

selected spin-outs. The findings can be useful as a basis for further studies of this phenomenon, including to examine the transferability to spinouts in general. The results also indicate potential strategies to overcome the challenges. Some of these are linked to the start-ups background in university, suggesting that their spinout roots might be part of the solution.

7 REFLECTION

The previous chapters have explained the existing research, the subsequent choices in methodology and the findings and conclusion of this thesis. This chapter discusses the limitations of choices made along the way and explores the implications of the findings in relation to both research and practice.

7.1 Limitations of this study

As with any research project, the research design and methodology put certain limitations on how the data should be used and what can reasonably be inferred from the data.

The following section outlines the most essential limitations of this thesis's findings and contributions to the general population.

7.1.1 General applicability

Due to the limitations caused by the multiple case study research method, the case selection and the semi-structured interview method of data-collection, there are uncertainties in applying the findings to a general population.

As explained in chapter 3, a weakness of this method is that it is prone to reaching narrow and idiosyncratic theory that holds true for the included cases, rather than the general population. The findings can be seen as having a high degree of trustworthiness in relation to the studied cases. However, The same findings would not necessarily also be found among other cases or respondents, as the patterns identified might be random or dependent on contextual factors only present in this study (Eisenhardt 1989).

Furthermore, the case study was limited to 6 respondents across 4 spin-outs. As outlined in Chapter 3, the limited emersion of new relevant data indicates a reasonable level of saturation. However, had time permitted inclusion of additional respondents, an even higher level of saturation could probably have been reached.

Finally, there were striking similarities across the selected cases: Namely, that spin-outs and founders were predominantly based in a technical setting and had a relatively strong connection to the San Francisco Bay Area in the United States, as well as a strong connection to UC Berkeley and/or UC San Francisco. Spin-outs based in a different context, may have a different experience.

However, several elements also point in favor of a general relevance of the findings in this thesis.

First, established theory and research was used to reach a contextual understanding, which served as the basis for the research framework. This meant that the specific cases were studied through a well-established perspective. This understanding of general issues, combined with contextual knowledge in relation to the cases, decreases the risk of irrelevant findings that are only related to the cases in this thesis.

Second, while the cases did have notable similarities, there was also extensive differences. Namely that the spin-outs were dispersed across 4 nationalities (American, Danish, French, Chilean), and had strong ties to communities and universities across 3 continents (Europe, North- and South-America). This could indicate that the commonalities go beyond the San Francisco Bay area and the UC-system.

Finally, it is important to consider, that scientific findings do not need to be generalizable in order to be valuable. The research area of this thesis is relatively unexplored. This provides a very poor basis for a quantitative study seeking broad transferability, since it is simply unclear what would be relevant to measure. Instead, it was found more appropriate to approach this under-researched area with an explorative research strategy. This enabled the discovery of unexpected findings, which can later become the basis for quantitative studies, seeking to verify and validate.

The goal of this thesis is a rich and in-depth analysis, which allows for understanding of phenomena in a small sample of cases. If it can be substantiated that these phenomena were present in the sample cases and it is possible to understand their context, which provides interesting perspectives in relation to the general population.

Even if the cases are extremes, it is the author's hope that recognizing the findings and context of these extremes, yields a new perspective on the interplay between effectual spin-out entrepreneurship and effective behavioral design. Furthermore, this thesis will provide a basis for the creation of new hypotheses and the design of studies that investigate these. Eventually, a confirmation or rejection of the generalizability of the findings and their impact might be possible.

7.2 Implications

Based on the findings in this thesis and their contribution to the intersection between effectuation and behavioral design, this thesis could hold valuable practical and academic knowledge. The findings in this thesis suggest implications for both research and practice in the intersection between entrepreneurship and behavioral design.

7.2.1 Implications for future research

As has been highlighted in Chapter 3 and the above section 7.1,

while the insights from this thesis provides a basis for understanding the phenomenon among the cases, the findings need to be further substantiated. If the findings are transferable to spin-outs in general, they would be important both for the entrepreneurs themselves, as well as for contributing to solving the UN Global Goal. Therefore, it might be worthwhile to consider strategies for substantiating the findings.

The findings in this thesis emphasize the need for more knowledge on how entrepreneurs shift between modes of decision-making. In practice, the participants in the study did not rely solely on effectual reasoning, but rather on a mix of both effectual and causal reasoning. Sarasvathy (2001) has established that entrepreneurs must employ an effectual mode of reasoning to a larger degree than non-entrepreneurs, but also that there are occasions where entrepreneurs must rely on a more causation. The findings from this thesis suggest that behavioral design is one of these instances. However, further research is needed to establish how entrepreneurs may do this in practice.

In addition, the findings indicate that there are possibilities for bridging the gap between an effective entrepreneurial process and an effective behavioral design process, to some extent. The primary method would be a combination of initiatives that lessen the demand for resources. Some of these initiatives have been briefly outlined in this thesis. While these initiatives have already been identified in prior research (e.g. Cash et al. 2017; B. J. Fogg 2009b), a more in depth understanding of the spin-out context, might help make the behavioral design process more available to spin-out entrepreneurs. Another implication is therefore, the need for further research into initiatives that lighten the resource burden of the behavioral design process.

7.2.2 Practical implications

While more research is needed, the findings of this thesis does point to some practical implications for spin-out entrepreneurs and other stakeholders.

Fundamentally, the findings suggest that there is a lack of understand of the effective behavioral design process, i.e. the effective way to deal with behavioral challenges, among the spin-out entrepreneurs. This lack of understanding makes it difficult for spin-out entrepreneurs to assess effective behavioral data and which of their means they should employ. It also negatively impacts their ability to determine when to abandon the effectual mode of reasoning in favor of a more causal approach.

Therefore, the main practical implication is the need for an increased awareness and understanding of the important elements in a

behavioral design process. Especially within the following:

- **Understanding the relevant means for an effective behavioral design process and how these compare to the means available to the spin-out entrepreneurs.** The findings suggest, that the spin-out entrepreneurs actually have an advantageous starting point for engaging in an effective behavioral design process. They master the skills for conducting one of the most important activities in behavioral design; exploring and utilizing existing theoretical frameworks. It is important that the entrepreneurs understand this advantage and are able to leverage it if they want to effectively address behavioral challenges.
- **Understanding the consequences of using an effectual mode of reasoning to address behavioral challenges.** The findings show that the spin-out entrepreneurs approached the behavioral challenges with an effectual mode of reasoning. However, this had detrimental consequences for the quality and usefulness of the data, which ranged from in-effective, to largely useless, to downright misleading. While the former is arguably an inherent part of the entrepreneurial experience, the latter is potentially devastating. As the spin-out entrepreneurs will most likely not be able to adhere strictly to the principle of behavioral design all the time, it would seem especially important that they are at least able to avoid the “largely useless” and “downright misleading” scenarios. If nothing else, this would at least mean not spending resources, however few, on activities that does not yield usable data.

The fact that the spin-out entrepreneurs had not sought out this information on their own initiative, suggests that there is a need for further encouragement.

In this regard, it makes sense to examine the knowledge sources that the spinout-entrepreneurs had access to and utilized actively. Through this examination, 3 potential channels to convey this awareness have been identified:

- **University network:** The spin-out entrepreneurs relied heavily on their university network, which suggest that promoting the awareness of an effective behavioral design process, through the channels within the universities, could have a massive impact. Ranging from actual university courses to facilitating talks and events, the universities have a great deal of experience in inspiring change and effective methods to reach it. Additionally, several individuals within the universities had a vested in interest in the success of the spin-out, and the universities associated with the spinouts this study, invest significantly in creating an effective

entrepreneurial environment. This indicates that there would be a good foundation for individuals and/or inter-university initiatives to promote an increased awareness of an effective behavioral design process.

- **Entrepreneurial support program:** 3 of the 4 spin-out were part of a type of entrepreneurial support program, which they relied substantially on. Like the universities, promoting awareness of an effective behavioral design process through these channels such as these support programs, could have a significant impact.
- **Online resources:** Another source of information and inspiration used often by the spin-out entrepreneurs, was online sources. Raising awareness of behavioral design through this channel would presumably require some more initiative from the spin-out entrepreneurs themselves, as they would have to actively seek it out. However, it is still interesting since several of the entrepreneurs would rely on this channel. Importantly, much of the information on behavioral design is available online (albeit perhaps behind a pay-wall), but it is either not in the places the entrepreneur looks, or it does not strike them as important. A different method for creating awareness through this channel could presumably be impactful. For example, anecdotal stories, thought-pieces or similar, from people the spin-out entrepreneurs look up to and/or at online for as they frequent and rely on.

7.3 Thesis project process

In the beginning of the thesis process, a project-plan was made. The plan outlined the key activities and their designated timeframe.

The original project plan can be found in Appendix B.

However, as often is the case, the project plan had to be modified during the execution of the project.

First, the literature review required a bigger commitment than first anticipated by the author. This may be contributed to the authors novice status as an academic researcher. In addition, the case study also required a bigger commitment than initially anticipated by the author, especially towards identifying cases that complied to the case selection criteria, as well as committing a sufficient number of individuals within each spin-out.

This led to a change in scope of the thesis. Originally, it was the ambition to accompany the thesis findings with an actionable tool to bridge effectuation and behavioral design. This ambition was abandoned in favor of ensuring a thorough answer to the research question, that can effectively inspire new research and, perhaps, the creation of such a tool in the future.

The updated project plan can be found in Appendix C.

The project plan outlines the key activities and their designated time-frame. While this was the overall process, the project was in practice an iterative process and there was more overlap between activities than appears in the Appendix.

During the thesis project, the author had bi-weekly meetings with both supervisors, which helped keep the project on track, and helped the author navigate the different activities and change in scope.

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APPENDIX A INTERVIEW GUIDE

Query	Aim
<p>Tell me about the start-up? How did that come to be? How would you describe the stage, that the start-up is at? (founding, launch, in between) How did you get involved? How long have you been part of the start-up?</p>	<p><i>To gain insights into the start-up context</i></p>
<ul style="list-style-type: none"> • Number of people • How long in pd process? <ul style="list-style-type: none"> ○ Founding ○ Launch (what steps are missing?) ○ Revenue 	<p><i>“Comparability between start-ups” - checklist</i></p>
<p>How would you describe the reasons that you joined the start-up?</p> <ul style="list-style-type: none"> • Is that something that have changed over time? • <i>How/Why do you think that is?</i> <p>How does [<i>aspiration</i>] influence your work with the start-up?</p> <ul style="list-style-type: none"> • Is that something that have changed over time? • <i>How/why do you think that is?</i> <p>How would you define the success of the start-up?</p> <ul style="list-style-type: none"> • Is that something that have changed over time? • <i>How/why?</i> <p>How does [<i>aspiration</i>] relate to [<i>definition</i>]?</p> <ul style="list-style-type: none"> • <i>Why?</i> 	<p><i>To gain insights into the aspiration of the entrepreneur, and the interplay with that and the start-up development</i></p>
<p>How would you describe the most important steps to reach [<i>goal</i>]?</p> <p>How would you describe the most important activities in the startup?</p> <p>Why those in particular?</p> <p>Is that something that have changed over time?</p> <p>How/Why do you think that is?</p> <p>Do you think that is something that will (continue) to change over time?</p> <p>Why/Why not?</p> <p><i>If yes:</i></p> <p>How do you think it will change?</p> <p>How do you think that will impact the start-up?</p> <p>Why is that?</p>	<p><i>To gain insights into the priorities of activities, and whether behavioral concerns are part of the priorities.</i></p> <p><i>To gain insights into the relation between time and priorities.</i></p>

<p>How would you describe the activities you work with? How would you describe your approach to those activities? Can you give an example? Is that how you typically approach a task like that? Why/why not? Can you elaborate on your reasons? Is that something that have changed over time? How/why?</p>	<p><i>To gain insights into the approach the entrepreneur employs.</i></p>
<p>How would you describe the types of methods, data-sources etc. that you use? How do you determine to use those types? <i>Can you elaborate on why those methods?</i> Can you give an example? Is that your typical approach? Why/why not?</p>	<p><i>To gain insights into the methods & data-sources entrepreneurs uses.</i></p>
<p>How do you determine if you have successfully solved a task? <i>Can you elaborate on?</i> Can you give an example? Is that your typical approach? Why/why not? Is that something that have changed over time? How /why?</p>	<p><i>To gain insights into the determination of successfully completed task.</i></p>
<p>How would you describe your traits and abilities? Is that something that you use in your work? How/why? Can you give an example? Is that typical? Why/why not? Is that something that have changed over time? How /why?</p>	<p><i>To gain insights into the means/resources available to the entrepreneur?</i></p>
<p>How would you describe your education, expertise, and experience? Is that something that you use in your work? How/why? Can you give an example? Is that typical? Why/why not? Is that something that have changed over time? How /why?</p>	
<p>How would you describe your professional and social network? Is that something that you use in your work?</p>	

<p>How/why? Can you give an example? Is that typical? Why/why not?</p>	
<p><i>If have NOT mentioned behavioral concerns:</i> You have mentioned [priorities]</p> <p><i>If mentioned behavioral concerns:</i> You mentioned [behavioral aspect] was a priority, how have you approach that? Why? Is that something that have changed over time? How/why?</p> <p>How would you describe the type of activities, that you have engaged in to explore [behavioral aspect]? Can you give an example? Is that typical? Why/why not? How would you describe your decision to engage in those activities? Why?</p> <p>How would you describe the type of data that you have relied on? Why is that? Can you give an example? Is that typical? Why/why not?</p>	<p><i>To gain insights into the current approach to behavioral aspects.</i></p>

APPENDIX B ORIGINAL PROJECT PLAN

	Litterature review (initial draft version)		Case Study					Tool		Report Writing	
	Effectuatio/Entrepreneurial process	Behavioural Design process	Methodology	Interviews	Interview guide	Set-up interviews	Perform Interviews	Analysis	Development		Verification
Week 8											
Week 9											
Week 10											
Week 11											
Week 12											
Week 13											
Week 14											
Week 15											
Week 16											
Week 17											
Week 18											
Week 19											
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Week 23											
Week 24											
Week 25											
Week 26											
Week 27											
Week 28											
Week 29											
Week 30											
Week 31											

APPENDIX C FINAL PROJECT PLAN

	Litterature review (initial draft version)		Case Study				Report Writing
	<u>Effectuatio/Entrepreneurial process</u>	<u>Behavioural Design process</u>	Methodology	<u>Interviews</u>		<u>Analysis</u>	
			Interview guide	Set-up interviews	Perform Interviews		
Week 8							
Week 9							
Week 10							
Week 11							
Week 12							
Week 13							
Week 14							
Week 15							
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Week 29							
Week 30							
Week 31							

APPENDIX D INTERVIEW TRANSCRIPTS

CASE 1

Interviewer: First of all, I want to say thank you, and so what I'm really interested in is in your experience as an entrepreneur, so there's not really any right or wrong answers, it's just your experience. And the purpose for me is to get insights into the medtech start-up process. From the view point of the entrepreneur. Um, but yeah, I read about it online and it's a new MRI coil?

Respondent: Yes

Interviewer: It's small, lightweight and flexible? Yeah. It has a more flexible fit?

Respondent: Yes. So right now the MRI coils, so for like, you know what the coil is..

Interviewer: I've read online that it's kind of a... Yeah... So... not...?

Respondent: [moves recorder closer] This way it's recorded. So it's... so in the MRI machine when you go into the tube and the tube is a giant magnet, courses you want to various strong magnetic fields to get a good image. And what, what the magnet does, is that it does... changes direction um... which is why... that's what... that's the way it makes so much noise in the machine. If you've ever had,.. ever had it, it makes a lot of noise. And then so when you changes direction, the atoms in your body, they also have a magnetic, um, is there a small magnets and when the magnetic field changes direction, they, they change directions as well and it takes them some time to change direction... like it is not immediate. And when they, when they change direction you can record. It's sending mixed of... creates like a radio frequency signal, like a radio signal and, and that switch up with an antenna to make the image. Because basically the image says, you know, when... it's in gray scale, so... when it's in white, it tells you it takes a long time to, for the, for the grading, for the magnetic, um elements to move and when it's black and takes a short time. Basically that's one way to look at the image and then different tissues at different times.

Respondent: And so that's why, you know, when he took of tissue that has a lot of... um wetter, usually it takes a longer time of correct for the, for the, uh, magnetic elements to to, to move it. And so that's why tissues with enough water are white and vice versa. And so, and so that's how you get the contrast, actuallyr. It's a, it's a, how much, yeah, how much signal and how much time it takes for things to switch and for, because it's a radio frequency signal need to pick it up. And so, and so, normally these are made of conventional electronics which is what this is made of [point to computer keyboard]. And because they are like any other piece of equipment, they are fragile. And so in case.. like any other piece of equipment like plastic and things like... so it's rigid and most of the time are not flexable and they're heavy and as you can... because they are fragile and expensive, they are designed in a way that fits everyone.

Respondent: Um, and they are designed in a way that's built to last. So as a result, if for instance a small or large adult, you're going to be scanning with exactly the same antenna and things like if you're like, this is actually, this looks like one of

the antennas (computer keyboard). So if for chest, I imagine it would put the antenna like this on my chest. And for me it's kind of OK. But if it's a small child, they say the child is this size and I put it, first of all it's going to be very heavy compared to the child. And then, and then I'm like, you have all these parts that actually don't see anything. And so that creates noise in the image. And same thing if you know, if, if, uh, if there is a distance between my buddy and the, antennas are like your cell phone, the further away you are from the tower, the lower signal you have, so the more image, the less image quality, you have when there is more distance. So that's the problem with MRI coils.

Respondent: And as a result, because the times are very long, um, and the patients should not move during the taking of an image which can last one to get when you measure, it's usually an example of five minutes and then over an actual exam or you take multiple images. And so that takes usually between 30 minutes and 45 minutes and the person should not move during this time. So if you have something that's very uncomfortable and that does poor image, that results in a poor image quality, uh, you're the scans failure. Actually often the.. or 10 percent of the time on average, they're like the.. um the patient goes in the exam, spends half an hour in the machine, it's very uncomfortable and they don't it, they end up moving, and because they moved them, the image is blurry and the readerist cannot see anything and they cannot do the diagnosis.

Respondent: So that's the problem where like our business promote changes, so we see a high amount of failed scans and they, and they are mainly due to the fact that the image quality is not as good as it could be. And also the patients are uncomfortable and a lot of the discomfort comes from the coil. So what we did at Berkeley... all of that to say that... haha... we have maybe a new way of making the MRI coil, by using printed electronics. So printed electronics is a new way of making electronic circuits instead of feeding like a plate of copper that you edge, meaning... like you're just as easy to just... to remove most of it in to the pattern that you want. And then you solder components.

Respondent: We've printed electronics or use a conduc.. um metric.. um the inks that contain a conductive material, the semi-conducting materials, and you print them like you would have on a piece of paper to deposit the materials just where you want them in the shape um.. on the. And, um, on top of that you... and you don't need to solder that necessarily. You can also print a classical components. You can print a resistor capacitor, you can print a transistor. There are many, many things that you can print. And so the... as a result you can do large.. on whatever subject you want. So in our case, it's very thin plastic that's very flexible and very lightweight. Um, and it's very cheap because when we wanted to do the same thing with, with the classical electronics, you can take a piece of copper that's that bigger on the support... and you would edge or you take a, like a piece of gold that's being an ambassador on the support rigid word and you would remove 90 percent of it just to have the pattern. So it's very wasteful and it's expensive. Um, so because, uh, so thanks for printed technology. Um, basically when our coils are much cheaper and way more flexible and lightweight. And because they don't have to last for 10 years because they're

not as expensive than we can afford to make them into something that's like a blanket instead of being like a strong, like a strong thing. So this is an actual prototype we use on babies from zero to five year old.

Interviewer: Can I touch it [prototype]?

Respondent: Of course go for it. If you don't have to touch it or anything, you can get the laptop. Okay, I think actually this is a pretty good approximation [computer keyboard]... the same coverage... approximately... this rigid and this weight. Maybe if you have... [interviewer taking picture] haha.. you can see the differences for... you know, it makes for a weird picture... haha.. the machine is noisy and so if you're, if you're a baby and I put this [computer keyboard] on your chest, then you're going to have problem breathing, and it can be very stressful. And that's a big problem with the pediatric MRI. If you have something that's snugly... that's comfortable, that looks friendly actually because it looks friendly, it makes a big difference for the kids and that's why we're here. The dinosaurs are actually.... so that was a kind of... we were looking at fabrics to go around [the coil]. And we said, well if it's going to be used for children, let's make it nice. And actually we hadn't realized back in the days when we made this decision, but this aspect makes a very, very bigger difference. Um, so first of all when we started putting vendors, everyone's like, oh, it's so nice when people like it, right? And before it [earlier prototype] was something that was, that was, um, that was one of the earlier, the earlier prototypes. We didn't put everything together with those things that we could switch of the blanket, so it was basically... but something like this that, you know, I mean, it looks OK and it's like a blanket, but it's not the same thing as that [current prototype].

Respondent: And the thing is that we've... we've had, um, uh, we, we've done trials in the hospital with a pediatric patients and there's been a couple of success stories where like the child, the child would come in and it would be very stressed out and unhappy. Um, and you know, we'd be skilled to have anesthesia in order to be... the child cannot move during the scan and then when the, when the child came in and so the dinosaurs, they really like them. So we started like naming them, say, oh, this is a dilophosaurus, this is a triceratops, blah blah blah. And that made him come down. And he could have like a blanket with a dinosaur... the blanket was a dinosaur on top of him that really smoothing down and he was able to go through the scan without the anesthesia, the simply from, from like, oh, you know, I'm stressed and all of a sudden they are dinosaurs and I can focus on the dinosaurs and stuff for things or something else. Um, and um, I mean that's an example that makes the difference. And actually in hospitals that are also in its infancy, American hospitals, I don't know about Europe's, but they're in a, they're at UCSF, even Stanford, a child life specialists or psychologists know well how children of different ages behave and react and so they do a lot of work to accompany these children through the exams and process to make it their experience. And they were also saying that this was a very good, very good idea.

Interviewer: So did you seek out these child life specialists?

Respondent: Yeah. We talked to a few of them. Yeah. So, so in the... the way we approach that... So we have tried it in the lab, but in the lab or is that like.. this is what we... because it's functional, right?! And um, then we wanted to re-test it. We gave it to a partner in a radiology department at Stanford who, uh, patients that it works nice, it's nice, but then, you know, he liked... he liked it so much that he said we should do... that the evidence we were given was that it could be a good product for a company because it's very different from what exists in it really has advantages. And um, and um, so that's when we started the process of like maybe doing your start-up. But, before we actually did a startup, we did a lot of of what they call critical customer discovery. We talked to about 250, um, different people in the MRI environment. And so that's like really wide ranging. Both nurses, radiologists, technologists, particularly, is the person who runs the scanner. Um, directors of hospitals, administrative people in the hospitals. But also like MRI engineering or manufacturers or anybody you can think of it could be involved in, in such a business we tried to go up to as much as possible. And, uh, it's during this process that you will understand, OK, what's the value that we're really bringing to the... to the customer and it's also an investment when we understood that, oh, MRI fails often because of the product which I told you earlier [current MRI coils]. And um, once you understand, oh, OK, this is the actual problem that we're solving in very specifically... like a specific as you can be, then you go back to your design and is OK, how can we alter the design to make it fit these things in this to make it... to make our product fit those needs and solve these problems. And that's actually in the mean time... like everything was running on the same time, right? So, um, that's when we introduced the dinosaurs. And that's true. So when we start talking to the children... to the child life specialists who really liked the dinosaurs.

Respondent: [Pause]

Interviewer: So was it on purpose that you had the dinosaurs? To intrigue...?

Respondent: Actually it was! It's... it's, it came from a good intuition that someone on our team had, which was we needed to create something that was resistant to weather any way around it, to protect it, and uh, and uh, this person decided that if we were going to do something for children, resisting... we can might as well put something nice around it. And then that's when she stood there. She looked at dinosaurs, she liked the birds as well. Um..

Interviewer: And that was the child life specialist?

Respondent: No, no, no. That was the person on our team, who was like an engineer on our team, who was designing the stack. Um, and um, and um, yeah, so like it was, it was luck, but then, you know, as we moved forward where you get a really, really strong feedback on our, the dinosaurs are so nice and as everything with a story like children really like dinosaurs. And then the child life specialist was like, oh, it's good because no, it's neutral color. So it works both for the girls and

boys. And whereas this one is a bit too pink [former prototype] and you know, it's maybe more better for girls and not boys and uh, so, so I mean it's an, it's an ongoing and iterative process. Where basically the process was we tried it out of luck or intuition and then read the feedback we got.

Interviewer: I see. And how did you get involved in the start-up?

Respondent: So we are four co-founders and two are professors at UC Berkeley and I used to be a post doc of their group and then there's another co-founder. He used to be a phd student, initially in the group if the two professors, and then he came onboard and then we all founded the company together.

Interviewer: And your background is?

Respondent: I'm a printed electronics, so a master of science.

Interviewer: So you have a PhD in printed electronics?

Respondent: Yes, yes, yes.

Interviewer: And what about the rest?

Respondent: One is a professor of printed electronics, one is a professor, um, expert in MRI and uh, and then the other is expert in printed electronics for MRI because he did his phd on this thing too [the start-up technology]. His PhD work focused exclusively on the development of this from the concept to the to the prototype.

Interviewer: I see.

Respondent: It's actually worked way, way better than anyone expected at the beginning, so it was very luck. I mean lucky. First the two professors met and they were new professors and they were like, oh no, what, what are MRI coils? One was like what is printed electronics, and the other; what is MRI coils, and they said can we make one and they did it and it works way better than they hoped and then the... um... we had a trial with them, have a pediatric radiologist at Stanford was a one of their partners in the research grant and she liked it very, very much and that's based on that feedback around here. There is something here and then once you realized that there's a potential, then we went through all the discovery process and looking at the numbers to find out that he also made a business sense to do it. They've made a business sense to do the company. It's not just about the technology, so it needs to go well with the business value that you're providing and the advantage you're providing.

Interviewer: So how did you... because it seems like you all are very... you are all very technically.. you have very technical competency. So how did you kind of bridge that to all the other competencies that you need? Like business?

Respondent: Um, so actually for that Berkeley's, here's a fantastic environment because, um, we first started doing a class on entrepreneurship that was designed for engineering students and that was where we first learned about the customer discovery process and we, so we did a bunch of interviews actually in fact already in 2015. If I remember properly? And, and at this time when we finished the class, we were like, we have no business. Like there is no clear value. That problem that's happening, there's no clear value that we're providing that apart from comfort, but nobody's going to pay for extra comfort. And uh, and they always, when we have the very initial prototypes and then, you know, we kept taking some classes on the side of doing our research work. I went to a bunch of, for seminars given by the law school for example, and start-up 101 and finances in legal terms and everything.

Respondent: And then we also want to do a program designed by the National Science Foundation called the ECOS program. And this program is designed specifically to help, uh, scientists who have a technological innovation interest understand what is the value that they can bring with this innovation. So we did that and then it was this based on the same methodology which is customer discovery, customer interviews, and after this program, after 100 interviews, so we had 200 at the time, that's where we were as. OK. So there is actually value. It's just a matter of finding it and framing the problem in a way that makes sense. And the highlights with... where the money is... where the money is lost. And then, and then based on all these classes we managed to... we had a mentor, first was a lawyer that used to be a patent lawyer in a business... in a normal company, so he had some business acumen, a very strong, he was a very good mentor. And then you know at Berkeley there was such a good environment for people who have different backgrounds that you talk with people of whoever the business experience and then they told you they help you move forward and that's also why we came to Skydeck because Skydeck is very good at as a very strong network of advisors of many different backgrounds and where we get our business advisebasically.

Interviewer: So that approach where you know that there's something that you don't know, but you need to know and then... so what I had heard you say was that, then you reached out to your environment and to people that might know. Is that typically your approach to problems, or areas where you don't have the experience?

Respondent: Yes, yes, yes, absolutely. And it's helped a lot a lot by the fact that Berkeley has so many like superstar people in every, every domain, right? So if you're looking for help for some very specific kind of help, you know, it's, it's somewhere around we just need to ask. And then the other thing was their programs are organized around helping people in your situation. Like Skydeck is a good example, even though it's more advanced. Earlier stage... um... like startup programs at lunch, um, or challenges like competitions where you have your pitch and then if they like your innovation, they're going to give you support. All these kinds of, all these kinds of things apart from Skydeck, which I think is really is, I mean it's a six month program with investment and we've seen like

hundreds of potential advisors that you can tap into with. It's, it's, it's a big thing.

Respondent: But what's embracing when you start, even as you start, there is always a resource that helps you get to the next stage. And there was never a moment where we're like, oh, we're stuck with this group and there is no way no one can help us. And how did you then find those problems? Because I, at least I, you mentioned that sometimes you know, you don't know, what you don't know, how did you figure out, OK, this is a problem. Probably we don't know anything about, we need some more information. Um, I would say it's, you're going to discover the, the problem, right?

Respondent: When the problem is right in your face and you're like, oh, we need to solve this now. Which is also why now the volume from my perspective, one of the reasons why people will say so much of start-ups are crazy busy all the time about high paced environments are exactly because of that, because you're doing stuff. And so as you move forward, you see things that are important to know, they come up as a problem that needs to be solved fast. That's why. That's where the height... the fast paced comes from. But um, so yes, that's the problem. Um, for example, uh, when they, when we incorporated and it's like there are all kinds of the thing that got pros, actually a scientist will, we know what to expect and it's part of the vision. And, and that's actually something we're used to manage, one of the problems that are caught up in, oh, we need to solve this. That is problems we wouldn't expect from the common sense or as you said, because we don't know that we don't know yet. So a good example is administratively speaking. So for example, when we registered the company, we had no money, right? So we found the program very nice, I was referred by UCSF, a QB3, which is an incubator for a bio-science companies. And uh, they offer a preliminary start-up process where they pair you with a lawyer, cabinet and the lawyer for free does the incorporation document that's in practice, like \$2,000 or \$3,000. And if you try to look at this on the Internet, you've been doing it for free on your own when you still have to pay like a thousand dollars of fees. Because when you register it's going to get a bit... you will need to know what you're doing to really make sure that whatever you're doing is good.

Respondent: Otherwise, it's like, I have no idea if it's better to have a corporation or limited partnership, I wouldn't know. Right. And so that the, the lawyer saying, do this, do this, do that, and these for us. And um, so I was like, OK, good. But I took care of it. Right. But then when they're lawyer advise was just follow the guidelines in there I'd received on the 23. And they, because we didn't pay them, they did what they're supposed to do and they were like, OK, good luck. And what I wasn't aware of is that I registered for the city of Berkeley to get the license and then the reasons was, I actually needed to register in California, which I didn't know either. Uh, and then, uh, what I didn't know for California is that if you're not going to register, but then you need to fill out this certain forms that are mandatory, uh, within a certain time. And that I only discovered when I got the second letter that said, by the way, you are overdue for that, right? Um, it's always kind of like, that's why I'm saying like, Oh, you received a

letter that says you're overdue on your taxes in California that you didn't know you had to pay. Like, oh, OK, well, you know, now I know. So that's um, and then they say, oh, and like for Delaware, for example, the tax deadline is not April 15th, but it's, uh, it's March 1st. So, you know, last year was our first tax filing for the company. So in March I was like, oh, let's be like... I have a month in advance, let's organize for taxes. And then I received a letter from Delaware, that's it. I owe \$20,000 in taxes because they were like, we were... because the way they work is they don't know anything about the company. So they didn't say this is the normal standard ways that people need to pay. Of course we had no money and there was no way we're having to pay \$20,000 in taxes. So there is of course like, you know, when you call them and then you figure out and then you fill out the proper form. And it's only \$500, but you need, you need to know anyway, and the way you know is you receive a paper that tells you you owe \$20,000 of taxes to the state of Delaware. And that's the, that's the funny things. And you're learning something new the next year, you know, March first when you file your taxes.

Interviewer: I see. So when have all of these.. fires almost it seems, coming up. Then how do you prioritize?

Respondent: It's, um, so actually, actually I like what people say... it's hard for me because I'm... that's something I don't do very well. I'm not very good at ignoring looking for in the future and just fire right in my face. But it's good to keep, um, is helpful and I'm trying to do that more and more. But to get your head level and say, OK, what's urgent? What's not urgent? For example, uh, on the same day I received an email saying, uh, your other year to pay your bill of \$35 for blah blah, blah please pay now and it's urgent. And the reason it didn't work is because some problem happened with the bank transfer. OK? So I could spend an hour on that trying to figure it out. And pay a in understanding why it didn't work out the first time are. And at the same time there's an email from your potential investor that says, Hey, I'm interested in your startup, can you send documentation and can we scheduled a call to discuss, and for the call I will need this information, this information, this information, and it's also like if you are going to call him tomorrow you need to collect you need to collect together and stuff. After awhile they always ask for the same thing. So you have the documents. But the very first time you were like, oh I have no idea but how to answer this question. And so then you're like, well the investor is more important. Whatever. So don't pay the dealer \$35 these today you'll find another day to do it and maybe you have to pay \$5 extra because they're not happy. And I would say that's how I prioritize, but I am not very good at it.

Interviewer: So there's both like urgency, it seems, and then also important. So then how do you choose what is important?

Respondent: Yes, so well, it is what's really the bringing value to the company and what's, what's, what's gonna make the difference for the company success or not. For the other firm I'm dealing with right now in the last few weeks of the areas you've tons of things all the time, and all of them are small things that need to

be done, tax returns for and accounting is a problem and the bank has also a problem.

Respondent: And um, and uh, we need to order that many supplies for the company. Um, and the suppliers, you know, what they want. When you buy something as a company, it's a bit more complex when you pay it online, you just, sometimes you just enter your credit card and it's done, but some days more involved, you need to sign paper work and you need to call them and blah blah blah. And um, and the thing is that I could spend my day doing it then nothing has happened right here. And so what I actually tried to do is to, not to look at my emails for most of the day when I can do that, um, during the day and say, OK, during like from 1:00 to 5:00 PM I will not look at my emails at all and just focus on doing this thing and then the focus is on doing this thing, of course like is in the top of my head. I know what I need to do today to move the company forward.

Interviewer: Okay, so changing the subject a little bit. Why did you join the company? Because it seems liek it was also a long process..

Respondent: Yeah, it was a long process! Um, so actually when I finished my phd in France, I was in a lab that was specialized in transfer of technology from like research to industry, um, and I was like everyone after their studies, you have ideas of what you're going to do, but you're not really sure. And in one of the things that's interesting to you at the time was how do you... which is why I have chosen the lab in the first place was the question of how do you make... how did you discover something in the lab and make it into something useful in the, in the real world, like what's the chain process? And that's why I did PhD in this specific lab. And then, um, when I came to California, uh, and I knew, I asked the professor from who I started working, and she had lots of ideas of application, like very, um, like I said, there's lots of ideas about applications for whatever the research topic we're researching. And so that's why I joined her because over there and he wanted to know... I want to... yeah, that was part of the process. Right. And um, and uh, and when I joindes she was like, well, we have this project that could turn into a startup potentially, we don't know, but that's interesting. So I joined on this project and then because you've worked so much on something that if there's a commercial potential it I wanna be on this, but, and that's how I first put the fruit in the machine, and then the mission to me to where I am basically.

Interviewer: Yeah, and how do you see.. for you what is the succes of the company?

Respondent: Um, the success of the company will be something that's viable and where we can move product to customers. We are tackling a very small market. I mean comparatively speaking. So it's a market that's good for... that's large enough to have a community that can be profitable, but we're never going to be. billionairs but that's not the objective. What really motivates us... if we can get some money along the way, it'll me be nice of course. But we, the main motivation is really let's make something useful to people.

Interviewer: Mhmm, so when you have reached that.. or... when it is out there, do you think then that you would keep working on it and improving it? Or do you think that you would do something differently?

Respondent: It's a good question. I have, if you know, once we were successful with that, I don't see myself working 25 more years on it. I would call it. And likely one of the main reason is that from a technology point of view, I think it's more, it's the technology is not going to change much anymore or it is not the part that I can work on. So I wouldn't bring a lot of value anymore by staying 20 more years on that. So I think I'm going to move on to uh, and what I want to do is stay in the innovation domain because I think it's fun. You can really. It's like finance, right? There is something that you can do good in the world, in the world if you apply it properly and um, and uh, that's something that I like, so that's what I'm doing.

Interviewer: And when did you launch the startup?

Respondent: Year and a half ago.

Interviewer: And what types of... you mentioned that you spoke to... you reached out and spoke to people. And is usually the method that you use to gain new information?

Respondent: Yeah, nothing beats talking to people.

Interviewer: What about... Yeah. So other people have mentioned like going online.. or I mean you're a scientist so maybe...

Respondent: Yeah, yeah, yeah. All right. So I take it back!

Respondent: Nothing beats talking to people, but before I go talk to people, you want to make sure that you, you, you don't want to waste their time by asking very basic questions or at least it helps to go online first and check. OK, it's true. Like these more or less the answer to my question and then then you can have an informed discussion with the person because the more, the more I would say, the more I... it's like a puzzle, right? It if you, if you're trying to figure out the puzzle and then the person talking with you has to describe all the pieces, it takes a way longer time and she's like, oh, I know they are as many pieces pieces. Where do they fit together?

Interviewer: I see.

Respondent: So going online is always a good start. Um, books sometimes are helpful. But um, the thing is that the startup world not just written [books], both actually, both online and in books is for software companies and software startups or the most I would say from my point of view, especially in Silicon Valley or in the bay area is the most common start ups you can ask somebody about, oh, we're developing a website.

Respondent: And these are actually a very specific type of, uh, of, of companies a lot of startups flooded with these, this, these guidelines. And as an example, one of the most obvious example is that to do an app, you need a computer to do our stuff, you need to print. We need to, we need access to a full lab with like a screen printer we need to buy inks, it needs to be lab regulated And, and then it's a medical device so there are a lot of regulations to, to, um, to, to follow. So, you know, if we like for us to get, to be able to sell our first item, it's going to take a year and a half or more. Whereas, you know, as soon as you have the minimum needed, you can just put a line and then you, iterations. And then when you're a VC is they ask, you know, about how many or how much revenue do you have every month, how many users subscribe every month and your zero because we need to get to the finished product before.

Interviewer: So what do you use instead?

Respondent: Um, common sense and also it doesn't hurt to read this stuff, but you need to read them from a criti... like critical, critical point of view. Like OK, knowing this is actually not true. And like knowing OK this is not true. And then talking to specific people. So for example, for a venture, since we're never going to go to a venture firms that specialize in software start ups or app startups, we're going to go to to VCs that specifically dealing with the life sciences, biotech, med-tech or these kinds of these people they know about the reality and they have better expectations.

Interviewer: So when developing the product, what kind of data do you use to... I'm thinking... I'm sure you use a lot of academic article for the printer because you know that. But what about like, so you mentioned the children really like the dinosaurs and you talk to a child life specialist, but I imagine there would also be academic papers about you know, how children perceive stuff.

Respondent: So yeah. So in the case of papers actually easier to go talk to the person because there's just so many papers you can find. So as much as I can invest in other place because Berkeley is great, because if you are part of the UC Berkeley Network and actually have access to a lot of payed articles in published academic journal, and also markets reports. The library at UC Berkeley is fantastic for that. So I tried to... any source, that's sorry... I try to use it, but when you're looking for 10 minutes and nine and there's no clear answer of invest when you're trying to talk to people. And so there, there is a limit to the things you can find online and there's a limit to things that are documented. For example, in market research regards, uh, there is, there are so... many actually reports in the markets for MRI scanners in general. But here is never a report on the MRI coils even though it's like a sub-product. There are players that are maybe a dozen companies that do them in the world if not more. And so you would expect that... that could be something... could be something that market research company we could look into. But, but there, there is no such a thing. So then, so that's when you talk to people. So you talk to people to know.... that's why you talk to like, we talked with the MRI companies for example. So we know from them that a coil is about like when they sell a scanner, the coil is

about 10 to 15 percent of the whole purchase price. So then you use the market, the scan... the market reports and MRI scanners to then do estimates and then you go to... we went to many many MRI clinics. They were different and we asked all of them very similar questions like how many coils do you have? You know, what are the problems that you usually get with them? Blah, blah blah. And then, you know, after you talk to 20 or 30 of them, there will be some certain like answers that always come back. And actually one of the funny thing is that you need to be naïve and play the inner something nice person every time, even though you knew exactly what they are going to tell you. But it's exactly like, oh no. Sandy Sorenson, Berkeley, I'm working on, on coils and actually, uh, you know, I do them in the lab I don't know anything about how they are in the real life. Could you please tell me about it? And then uh, or they, they there from the start and like the story in the first five minutes is almost always the same.

Respondent: And then when you pick up things in a certain amount, when you do things this way, where do you see things that way? And then overall we know that all MRI units are between five and 12 cars basically. Sometimes when they are very rich they have more, but they use on a daily basis like seven to 10. Um, uh, and you know, the problems they have is a patient doesn't show up or the patient is not comfortable and doesn't stay in the scanner or the patient has claustrophobia and is anxious and um, and you know like so every time they tell you this, you make a list and then, you know, after talking to 20 there will be like 15 that would say that claustrophobia is the number one problem, and then five will say that patients not showing up is a problem and then you can then you can get the very fine detail because then you realize that there are so different MRI clinics, right?

Respondent: Sometimes when you go to an MRI clinic is just down the street and there is one person is like a privately owned on thing because it's very small. And then sometimes you need to work in a hospital to get there and of course it's very different and then the answers vary slightly and that's what you look for. You like... you look for answers are the same wherever you are, as long as you have in the MRI. You have all like... for example, wherever you are, you want the MRI to run when it needs to run because otherwise you lose a lot of money. Uh, but then if you're in a hospital or in a small clinic, the reasons for why you may have a certain problem is very different. And you know, in a hospital is unique. Patients come on the bed and there are inpatients and sue if you, if they don't show up somewhere in the hospital, whereas if you're in a clinic and your patient doesn't show up, they can walk by themselves, they can be anywhere. So, um, so it's very, it's a very messy problem. Like, not problem but it is a very messy process, so that's why you need to talk to a lot of people because it's not just one person that has said that... like 10 people have said that to know. OK, I know that this is actually true.

Interviewer: Yeah. OK, so you're talking about, because... I was thinking... 20 to 30 people and you had 250 for the customer discovery... so that's how you usually do it. But have there been any cases where you have had less people?

Respondent: Yeah, I mean of course. So for example, for us a problem or a problem, is that hospital administrators or the like the people who control the budgets and are the ones who make the final decision, yes, we're going to buy this thing. And, and they are very hard to catch... for instance for interviews where you go for technologies or MRI radiologist just walking in the MRI unit as if you're a patient and you say, Hey, I am at UC Berkeley can I have five minutes of this person's time. And then usually there's someone available. Um, and if there's nothing then you'd take your car to drive five minutes to get to the next one and you ask again, and then there's someone who's available. Um, but the administrator or you need to like have a meeting just on site. It's harder. So we talked to maybe five or six of them overall.

Respondent: Um, and you know, you would think, oh, it's not a lot and it isn't a lot. But on the other end they all said what I care about is costs and it makes sense because they're responsible for the budget. And they all said, you know, if you tell me I'm going to save that much costs every year... like they usually cost me 100,000 dollars every year and yours cost 50,000, of course I'm going to buy it and you don't need to... I mean this makes so much sense that you talk to five of them and they say the same thing. Then I could waste, like keep, keep spending the last night time trying to talk to five more. But it's pretty clear that it make sense. And it just seems pretty obvious.

Interviewer: What about the child life specialists?

Respondent: Actually, we only talked to a couple of them... and same thing because we talked to a couple of them at UCSF and we talked briefly to the equivalent at Stanford.

Respondent: Um, and um, we need to go to like, it's like something we need to hunt down the people and in their case, same thing, like, oh, of course it's better to have a dinosaur or something that's friendly than a, than to have something that's gray, that's gray in and that looks like a cage. Right? Um, and they also have actually, as you were saying, there is, there's been studies and so they can refer you to the studies and then you get to, you're getting different perspective at once. So the idea is that you want to come with an objective mind and be ready to challenge any of the assumptions that you have, but if it's something that's of use and that keeps being validated and you have no reason to doubt it, then you're like, OK, it's pretty safe. And even, and then the other question is, the question is OK, and if I were a route on this specific point, is it a big problem here? The question is, is it better to have dinosaurs or birds? Do we really care? No. If the question is do we need to bring like... if the question is; are \$50,000 too much for the... is it too expensive for the director to buy? Yes or no? That's way, way more important because if they say it's too expensive and we're never going to sell it and then the business is going to crash. So that's also where you decide if it is worth hunting five more of these guys or five more of these guys.

Interviewer: So how do you validate it? Like for instance, that it should be the dinosaurs? Or that it's comfortable?

- Respondent: Um, the comfort, that's were, that's where we did.... we gave the, we actually kept giving prototypes every new generation of prototypes to our partner at Stanford. He's a pediatric radiologist and uses them on his patients. And he's scanned more than a hundred pediatric patients now and, and, and then gives us feedback every time. So the first time he was like; hey, it's nice it that's potential, but it's not good enough because you wanted to move to like more surface, like larger things. And then when we get into the other, the next... the two generations... the next prototype, he was extremely happy about it and everyone was happy about it to the point that if it breaks, he calls us and we need to repair it within 24 hours for tomorrow. So we drive to Stanford, take it says OK this is broken. That's where, you know, OK, they actually like you to bring that if... or even sometimes when they wanted to do some tests on it and we took it away for half a day. And, and actually my, those, my colleague who was there and when he was walking away with it the radiologist just came in and said Oh no way. I need it for 2 hours, you know, you cannot take it away now.
- Interviewer: Nice, that seems like... and um we have 10 minutes. So I just wanted to know a little more about your um network. So it seems like use a lot of the UC Berkeley, and you obviously have a lot from the technical side, so how would you describe like your network is, and so there's also a lot of doctors at Stanford...? Like the field of expertise...
- Respondent: That's from scratch, so you of course you start from your own network of people that you know that share your expertise usually and then you grow out of that. So the way to grow... you ask or whenever you have an interview with someone who asks for two or three more people, you should talk to him and then they can refer... they can basically in case they refer you to them, talk to this kind of person and then you look on the internet or Linked in is fantastic for that. Or I'm looking for this kind of person or where can I find them? And then you try to call them and usually if it doesn't work very well, you could email them. Sometimes works and sometimes it doesn't. The more specific you are in your email to the better it works, and the best way is what you did, which is to come and say, hey... and that's the best because right is you're in front of them, they're going to tell you to talk to you, to you for 30 seconds and if they're extremely busy and then you say, can I come back and get them to come back and then tell you when to come back and then you can have a discussion. Especially when you say that when people do talk to you about themselves, which is exactly what I'm doing and exactly how you made me talk to you. It's about like never. It's very rare that someone is going to refuse to talk to you.
- Interviewer: What about like reaching out to patients? Because it seems like there's a lot of experts, did you...
- Respondent: A little bit. Um, but the patients are not... patients do not bring a lot perspective to us, uh, because uh, patients don't really know what's going on. If you're lucky, your patient is knowledgable, but then you learn as much from them that you would learn from a technologists. And then if it is someone that doesn't have a

clue, really, yeah, I had a terrible experience in my MRI. And that's helpful because then you know, oh yeah they do. But then again, it's always the question of why would you talk to and what are you going to learn from them. MRI are terrible for people that everybody agrees on that. And then the question is, Oh, you've improved comfort. Can you make someone money, and would someone be willing to pay for our product. That's the real question. And then it is not the patients who are going to pay for it, it is the administrator of the hospital. So that's what we focused more on the hospital side, than the patient side. And eventually we can ask patients, would you prefer this or that? That's really way down the road when we finish the product and we are tackling the small issues of the prototype. Is there a smaller design?

- Respondent: Yeah. So how, how long until you think you are going to launch it?
- Respondent: So we hope to be actually starting to give a... to get... to sell as much as possible prototypes to research hospitals, uh, because they can take it as a research tool and use it as a research tool. But um, we expect within six to 12 month being able to pass FDA and then make something that we could sell actually.
- Interviewer: And so if you wanted to talk to patients how far down the road you're thing that would be?
- Respondent: Um, well, I mean that could start now. Or it could be when we start making something and giving to research... actually are our partner at Stanford he does that for us now. So when he makes the... when he scans the patients, there is a questionnaire that they asked for the parents and the child what he thought. If he thought they would prefer this one or others or the previous. And they always say, oh, we want this one, of course, because it's nicer, more comfortable. So you can do it this way. But actually, what could make us talk to patients depends on what we would gain from it. It's always why... why would you do that? What's the objective?
- Interviewer: And do you think you would gain something from patients that you couldn't gain from the radiologist?
- Respondent: It's possible to be honest with you, to rethink about it again. You're right, you're right to say that it, it could be interesting and we should do it down the road at some point, but it's, I don't see us doing it. I mean it's still a priority then you earlier. It's not a priority as much as other things, which is making sure that we follow the regulations and can actually sell to somebody. Yeah.
- Respondent: And what would you say was your, I mean, now I know your education, but what is your expertise and the team, I mean can also go beyond... also just like a personal skills...
- Respondent: I am the one who's more on the business side of things just because that's, that's how it started. So we were a team of four but two are professors. They

are in... they are student professors so they only do that on their side and so they cannot put as much time as the um, as they would if you didn't have the professor. I'm going to spend a lot of time too on it myself, so I'm very, I'm very grateful they're, they're extremely busy. Uh, but you know, um, when we started the company, the other full time co-founder was finishing his phd thesis, so he had to focus on that. So I started taking care of the current state of things and kept doing it because I just started. So there's no reason for me to stop where you're like, that is different. I like that it is a new challenge every day. You never know when you'll receive a letter telling you owe\$20,000 to someone. Um, it's frustrating sometimes because it can be very overwhelming for stupid reasons, but it's a good challenge. I wouldn't do it all my life.

Interviewer: Thanks this was all I had. Almost on the clock!

CASE 2.1

- Interviewer: So this is... there's no right or wrong answer. This is just about your experience, so just be open and honest. And as you probably know I'm writing about start-ups. I'm curious about the entrepreneurial data process and specifically more related to the product development. But first... I know a little bit already, but tell me in your words about the startup.
- Respondent: Cool. Well what do you want to... do you want to talk about? Kind of a background or what is generally about?
- Interviewer: Mm, yeah. I was thinking more highlevel of what, what do you see as the, the aspiration of this start-up?
- Respondent: aspiration? Well, I think for us is that we eventually want to create a technology that's going to be able to treat patients with Alzheimer's. Right? And something that is comfortable, something that it can be kind of, how do you say it out of, out of the way where maybe it's in the lighting system where you can't even detect it at all. Um, where you just walking the room and you won't even notice it? So that's like the aspiration. It's that infrastructure lives we would like to get there, but we need... that takes a long time and a lot of clinical testing and a lot of partnerships. Right. So it'd be a long road, but hopefully fun road with that team.
- Interviewer: Yeah. And how did it come to be the startup?
- Respondent: The startup? Well, it was kind of interesting because yes, he [future founder] actually gave a talk here [UC Berkeley] in last November, so almost two years ago. And uh, he was just talking about blue light and how prenuer plume with Blue Light and how circadian rhythm worked. And uh, I was there as the student assistant and before the talk started I came up to him and I was like, hey, how's it going? It looks cool, your slides. And he was like, yeah, it's really fun. We just got to figure out, you know, how to tie in circadian and light because our team works with light. And I was like, Oh, I worked with circadian. So that's how it came about of having the starting of the conversation. And then this paper came out in nature for MIT and it was basically saying, you know, um flickering light at 40 hertz, can reduce 52 percent of plaque development in the brain of Alzheimer's patients or alzheimers mice, not patients. Um, so yes, and it was like, you know, it was really uncomfortable. It can induce epilepsy. Can we do something? And I was like, yeah, of course we can't do that. Why don't we just mask the light and, you know, he was like, oh, that is possible and then we created a patent and um, that's all.
- Interviewer: And then you also talked about, so that is kind of the technology behind it the patent. But you also mentioned that it should be comfortable and out of the way. How did that come about?
- Respondent: Uh, well, a lot of the products are out there today do have like, you know, the seasonal, the seasonal depression, the um, all of the flickering light is kind of like

right in your face and it's kind of bothersome or you have to stare at something for a long time. Um, so the goal is that most people will get bored, you know, doing it, if you have late stage Alzheimer's, you're going to do it no matter what because you're trying to get anything to improve your health. Whereas I want it to be more of a why can't we just change holistic wellness and someone's wellbeing before they even get to the stage of Alzheimer's. So you have, let's say, Alzheimer's that run in the family and it induces kind of circadian disruption. Any kind of sleep disorder ended up having your chances of getting Alzheimer's much higher. So what we wanted to do is that, why don't we just set it up into something where even though you're in your thirties doesn't necessarily mean that you can't improve your lighting, especially with this day and age where we don't get a lot of natural light. It's the ambient light. Um, so that's why I was like, well, why can't it be in this? Like um kind of a subtle exposure to the light. Um, whereas for treatment you have to stare at the light because you want to amplify the effects of it.

Interviewer: I see, okay. So even so is it correct if I... just to make sure I understand you correct. It's kind of moved from treatment while you stay at the lights to treatment that works as substitutes for natural light?

Respondent: Yeah. Eventually, you know, right now clinical studies is everything that stare at the light for 30 minutes to an hour. Um, would you imagine just sitting there and staring at it? Like what, 30 minutes, an hour you'll do it if you are losing your memory and losing your cognitive function. But if you tell someone, hey, if you do this, it'll help you sleep at night, you know, help you improve your circadian rhythm and ultimately help with Alzheimer's. Most young people will be like, no, I don't have time for that.

Interviewer: And you got involved by hearing a speech at your university?

Respondent: Yeah, well no I got involved by just talking to [future founder] at the beginning of the talk. So I was like hey how's it going?

Interviewer: And what was kind of your... So at that point it was really, really early stage. So what was kind of your own aspiration for getting involved?

Respondent: Well my original thought was not really getting involved in a startup, it was more of doing research together. So that was my original plan of like, oh, okay, we can look at this in a research aspect because I am doing a phd in more of a research. So, um, we just started talking and the other like, we're going to do a... he's like, oh, maybe this could be a collaboration between the two universities. And then eventually it became like, oh, why don't we start a company? So it was, it was just a nice transition and I think I got kind of lucky in a way that [future co-founder] is so entrepreneurial in his mind and his mindset that like he was thinking the whole time it's going to be a company. And I was thinking like half the time, okay, this is going to be a research thing. So, uh, that's how it was.

Interviewer: So, so how do you feel about it evolving from a research project to a company?

Respondent: I like it, you know, it's, it's fun. Um, I, you know, all of us, if you look at the team, all of them kind of wanted to get a phd or masters. They didn't really... they don't have the startup experience, but it's kind of going in a way where now everybody's excited about it because they want to learn and I think that's the most important thing, right, is getting a team of people who want to learn and they're okay with stepping away from getting a phd for now and then just kind of working towards a goal together.

Interviewer: [inaudible] yeah. And you already mentioned learning. Can you describe a little just for yourself or your aspiration are about now not doing the research but then doing this start-up instead?

Respondent: Okay. Well I think it's interesting because at first when I was just helping out with the startup, I didn't really think about it as like, me being in any position is more like, oh, let me help with R&D and then that would be my position. And then slowly became, okay, maybe Mike can be the CEO. And I was like, Oh shit, what is going on? And so it, it's, it's a, it's a huge jump, but the good thing is that I had Rasmus, you know, he's a, he's a business entrepreneurship, a angel investor guy and him and [future co-founder], we're like, no, it's fine if you don't know anything right now we'll groom you to, to understand because it's all learning process. So, um, it's been interesting and I think it's, you know, I've always been a bossy person so it's kind of nice to be able to boss Marcus and them around.

Respondent: But that's the experience. I assume I still have a lot to learn actually. Especially when you start out with a startup, it's not like you know what to do all the time. You learn like, okay, how do you form a team having a lot of doors slammed in your face and then having a lot of people say no, and then eventually you meet the right people, develop the right team. And then, um, you know, fortunately for me, I've already had that at the beginning, but a lot of people don't. Um, but right now it's all about like, okay, there's patents, there's lawyers. And actually we just had a meeting with the lawyer yesterday and he was like, okay, I didn't, I don't know how to do any of this stuff, but it's learning process. You learn also when to let people go. It's kind of interesting.

Respondent: That has been a little harder for me just because I feel I, I see a potential in everybody that I work with, but at the end of the day it's more of how do you move forward as a team and as a vision if someone else doesn't have the same vision or work ethics as you do. So you have to kind of have to learn to be like, hey, you know, let's have a conversation kind of thing. And that's been the most difficult part because you know me, I'm more of a come let's that's hang out kind of thing. So.

Interviewer: So what is your approach to that? Both the in terms of, as you said, getting to talk to the right people about something that is probably difficult for you to assess because it's the first time you have to deal with it. And also then knowing

whether you maybe did the right assessment also both of people, but also in terms of their competencies and...?

Respondent: Yeah, so I try to, before I even go in as anything with anybody, I say, hey look, this is a high risk, high reward kind of situation and um, you know, the number one thing that I've noticed is that if you're going to go into to be a team member with anyone I'm working with anyone, if the first thing that they talked to you about is equity and how much they're getting from a company, then they're automatically out because often times those are the people are just there to see how much money they can make in a company and not there for the project itself. Right. And especially some of... a project like this is more, it's a long road, it's a long game, it's like a marathon and we're doing it for a cause so often times we're like, okay, how do we make it as cheap as possible and also kind of user friendly as much as we can for the elderly.

Respondent: So that's why we were saying we don't want to sell it off or something really expensive. Our main goal was to mainly do something that is good for society, but then in the end can help us develop centers and develop kind of, uh, programs for other people to come in for other students to come into work with us. So that was kind of mine in Marcus's goal I think. And then I think having a conversation, which with every team member helps because I'm at the beginning you don't really know everybody, but then as you go along you'll see people's characters and how they are and what they really want in terms of vision for the company. Um, so, and that's in terms of people who are investors, you can, you can kind of tell the, the ones that are kind of sneaky the way, the way that they talk at the beginning, you know, and you do have other people telling you to.

Respondent: I'm like, I have friends or like, yes, it will be like, you know, I'll ask, always ask the opinions of your team member to like for me, I'll be like, oh yeah, this person's really good person, but then maybe they are a good person to me because they, they, they assume that I'm the person who's going to lead this, but then you want to ask everybody else on your team and they'll tell you like, oh, you know, uh, I know them or I don't really know them and uh, or this is my take on them, but never take another person's just only that person. Right? Because they might not like one person because of maybe one thing they did in the past. So it, it's, it's a, it's a game of knowing when to take advice and knowing when to not take the advice of the person. So it's, it's difficult, but it's been a learning process.

Interviewer: So when you assess what people take advice from, because that's also what I hear, that, you know, you get so much advice. So it's also the question of, which one is the right advice? Then you ask just to make sure that when you ask you other team members what they think, and it seems like that also goes to the character of the person in...?

Respondent: Yeah, yeah, yeah. Um, oftentimes you'll get different advice from many different people. Even like with mentoring, right? You get like this person will

tell you, no, that's a horrible way of going, but another person will tell you, oh yeah, that's great. You got to pick and choose small things that they tell you within the whole entire conversation. But if you consistently get all everybody telling you the same thing, that means you have to pivot or do something else because often times you get so many different advices. But when some one main thing that comes up over and over and over again, it means it's either a good thing or a bad thing, whether it's a good advice or bad advice because they didn't have a conversation with each other before they talk to you. So you know when that advice should be taken and when it shouldn't. When every single person you talk to, a majority of the people you talked to say, Hey, I've experienced this or I haven't experienced this, but this is a good product, or I don't think this is going to be right. Maybe you should try to pivot just a little more so that those were some kind of little cues that you can get.

Interviewer: And what if. So, yeah, if they say the same, you're going that direction. But what if they say five different things? Or just two different things just two different things?

Respondent: Um, oftentimes you then at the end of the day, you got to go with what you feel and what your team feel like. You're, what you, what you believe in. Right? Like many people have told us, I don't think that's going to work, but then there's a lot of people will say, well, you never know unless you try it. And because they're just. Because there's not researching it doesn't necessarily mean that it doesn't work. And oftentimes most successful startups are the rule breakers and people will tell someone, no, it shouldn't work. And we've done a lot of research on, you know, color scheme blending and light to know that those separately work, so, but no one has ever done blending of the two, so you know, no one can tell you if you're right or wrong in that aspect. So you just go with it. It's high risk.

Respondent: But like we said, Alzheimer's is a pharmaceutical graveyard, so it... people have spent billions of dollars on that end. We're only doing something non-invasive which has no side effects. So we're hoping to even move a little bit in terms of it might not cure the disease, but if it slows it down just a little bit it is a small improvement.

Interviewer: You mentioned there wasn't a lot of research.?

Respondent: No, there's not a lot of research. Even the, um, the prototype that we built, the five driver chip that we build, it's actually you cannot buy on the market at all right now. We can actually just sell that and be a successful company at this point in time. There is a European company that's selling a four driver um chip, but it costs like 32,000 kroners, which is like \$3,500 or something here, which, which we can probably, we can make for \$100. So, so, so just being able to get a five driver and make for \$100 that can send different kinds of signals and wavelengths and be kind of totally accustomed to a software and move that's already something that's successful with all startup you will fit no matter what you're doing. And I think having the conversation at the beginning and that's

why I emphasize the importance of a team. I think at the end of the day, even if our light technology doesn't work, we have such a strong team that we can build anything and be able to be successful, you know, and like Marcus and I've already talked about it with um, Gustavo who was the hardware guy and he was like, yeah, anything you want to build out.

Respondent: So as, as the technology is growing and growing and you just gotta keep reading about it and learning about what you can, how you can destroy the market and put yourself inside of it, you know. And so it's been fun to talk about. You always have to talk about if we're successful, but the conversation of what if this doesn't work, always had to come up and say at the end of the day, keep your core team together and you're just like Oliver's Norlase, right? They, they did something for what, five years now they have this new technology and they're, they're pivoting and in the way that they're going, but their teammates, others because they're able to succeed is that everybody on the team is all in on this. The idea of the team. I think as great of an, um an idea that you have, if you don't have a good team to actually execute or even develop anything, it's not going to work out.

Interviewer: So, um, would you... So how would you describe your kind of aspiration for that venture? Is it... It sounds like it's more doing something with that team or is it... you also mentioned previously you had a cause that you wanted to improve in society..?

Respondent: Yeah. Yeah. I mean, I think the main goal of what I wanted to do is to, to make a difference in any way possible. And I think being going towards the light and this new technology you can make a really big difference. Um, but at the end of the day you should know when is, when you should stop, you know, there are cues along the line of clinical studies, along the lines of user validation and how, if and when it works because if you just keep going down a rabbit hole, you're not going to be successful as a lot of people just go and go into bankruptcy and go into debt just because they feel, they feel like their ideas sometimes an idea needs to be shot down. Um, and there there's a certain point if there are certain points I shot down or it's basically popped and then it moves to something else.

Respondent: Um, so yes, I think my, our ultimate goal right right now is to develop this technology and be re-tested. Um, you know, I think last year this is what, 100, \$500 million dollars just given for Alzheimer Research for the Gates Foundation and um, it's all pharmaceutical is all small research that are more on the invasive side and I think they've used a lot of it and have found nothing. So you know, for us we know we're going to get the investment because it's, it's, it's, it's Alzheimer's, but we don't want to waste the investment, as well. And so it is right now the goal is do something good, do something that will allow us to help society. But ultimately it's also to work with a team to say what if we do something else that still helps you know? And our goal is still going down this road. And if we do need to pivot, I think we have like 20 other ideas that we want to do.

Respondent: But focus is important because if even if you have like five great ideas on how to make a company go and have the technology for it, like we can you use this lighting system for a lot of things, but focus is key. So if you don't focus on the one thing, the main thing that you want to do and you're saying, oh maybe I'll do this, this, this and this. You're spreading yourself out way too thin and then it's just gonna end up being, you're not gonna, you're leaving things undone in all the, all the places. And so for us, we chose this path and we're going to go through this one. And then later on, you know, as a clinical study is, is going to happen, I think it's going to take like two or three years where we actually are going to do a little niche because that's how you're going to make some money and that's how you're going to get yourself out there.

Respondent: So our niche is circadian rhythm for sports and athletes, right? But because we can't really do anything during those two to three years besides wait for data, that's when we can kind of do something else in the beginning stages. We're like always focused on building the prototype, getting you know, the right people and the right connection and having a conversation with them and saying, hey look, we're actually intelligent people who have done the research, will you help us? And one of the most important thing is having a good board member and board of advisories.

Respondent: Those are the people who will tell you more and more, especially leading industry people are leading researchers who can say, I don't think this might work, or why don't we give it a try. A good thing for us is that we've talked to a lot of doctors who are like, oh yeah, this might seem really interesting. We have, um, we have a very diverse team in terms of people who are endocrinologists who can take hormone levels for us. People who are FMRI specialists who can say, Oh, you know, we won't charge you for you to use. Or the only thing we'll charge you to use are x-rays, right? And um, we'll do the analysis for you for free. So the little, the little things that early on in a startup that if you don't get the right people who kind of will help you out along the way, you're not going to succeed.

Respondent: Like for us, we have the largest hospital in Denmark that is going to help us with clinical study. We have a cognitive, a professor who does research on cognitive function who will help us with the questionnaire and being able to negotiate right at the same time, they're not get there, not being a, how do you say it? They're there. It's not like they're not getting anything out of it or saying, we just want the data and we want this, but how about you get first author on this paper that you can publish whatever you want and we will just be somewhere at the end. And especially knowing what's important for researchers and what they value more is very important as a company because a lot of companies will go in and say, okay, we'll pay you for this. And uh, just do it for us, we know we don't have the money to pay them for it, but I knew as a researcher myself that primary literature and being the first author, second author on a paper, especially in a growing kind of literature environment, is very important. So offering that up and saying you can take the lead on this project is something that is valuable to them and is worth a lot of money, right? Because we can say

we'll pay for the x-ray will pay for some of the stuff, but all the analytical stuff that takes a long time, they're willing to do it because they're able to get a publication out of it kind of thing.

Interviewer: And how do you um like identify these activities that you need to do in order to reach your goal and then find the people to do it?

Respondent: Um, I think going back to a diverse team, we have engineers and then we have researchers right now, I always think that the most important thing is to have a diverse, diverse thinking group, especially if you're going into med-tech. Uh, oftentimes there's a bunch of engineers that go in and they assume they know what they're doing, but all they know is hardware or you have a bunch of business guys who are going into a project who wants to do something and a, for us, we kind of, we had marcus who was a physicist. We, [future co-founder], who was an entrepreneur who was already in the network. So having a good mentor who, who already knows network somewhat. And I'm going.. I went to a lot of conferences and we presented our work. And DTU are... light work at DTU probably last summer a doctor e came up and was really interested in it.

Respondent: And uh, he was able to connect us with another doctor. But at the same time I think I knew we had to go into clinical studies and I knew we needed people from KU and not just DTU, Um, so having that capability of having someone who had done research before and saying if we, if we ever want to get this through, we have to go through clinicals and then going as the clinical people and doing a lot of, um, how to use it, surveys in terms of the kind of specialists that you want to ask. So you just go around and ask people, Hey, who do you think would be able to help us? Um, who do you think this is the right way of going about it? And uh, we just so happened that we talked to one person and then the next person just said, oh, I know this, this the top FMRI personally, so maybe she'll help you with. And a lot of times it's who you know is not what you know.

Interviewer: And then when you meet these people for instance, it seems like kind of arbitrary, maybe conferences. So then how do you asses that? The good advice that they give? As you said, there's a lot of advice.

Respondent: Yeah. You, uh, you kind of have a conversation with them and know if they know that 1: they have to know the material, have to kind of somewhat have an idea of what you're talking about. And um, they oftentimes they don't just jump to, Oh, I know a group of Angel Investors. They just say, oh, this is a really interesting topic. Do you want to have coffee and talk more about how you're going about it? Um, I don't always like jump the first time meeting someone. Usually that's how it works. You will meet someone and say, okay, how about we sit down and have coffee? And I would invite the whole team, like Marcus, yes. And everybody and we all sit in the office and kind of have a conversation and at the end of it, you know, say, okay, what do you think of this?

Respondent: And oftentimes if they know what they're talking about, you can tell right away, especially you bring up certain names or certain techniques. They would be like,

oh yeah, you know, I did this and this and this. Some people are just a fog. Do you, do you know what that term is?

Interviewer: You can elaborate a little more.

Respondent: So people would say is that they have a beautiful resume and then they're like perfect on paper, but when you start working with them and talking to them and kind of interacting with them more, you can tell that it's just, they just write down as many things that they can, that they kind of helped a little bit, um, that they touch on, but they just write on their resume. So they actually never done the work themselves, but because they were a part of it in a very small aspect, they, they write it or they just boost up their resume for things. So that's what we mean where a lot of people are just, are just fog or smoke. And so you, you don't really notice that until you go through and see them.

Interviewer: So the... So the fog, how do you determine, I mean, it must be difficult in areas where you're maybe not familiar and maybe not, I don't know if you've ever been in that situation and you maybe not know what the...?

Respondent: Yeah, I mean I've been in that situation and uh, it, it, you learned the hard way, right? You start working with them and um, you start assigning them stuff or your team members started working with them and you're already involved in kind of like, oh, this is the payment that we're going to give you a position and then you have to make the difficult decision of how do you not burn bridges but slowly phase them out of the project, but you learned the hard way. So there's always those kinds of awkward kind of like, Damn, I made the wrong decision, but it's okay. Like at the end of the day, it's a learning process and you will make the wrong decision a lot as long as it doesn't kind of get you down and kick you and keep you from doing the work. And I think it's fine, but that's what startup is a great unknown. And as literally, um, how do you...

Respondent: One of my mentors said I had to get punched in the gut. Every time you talk to somebody because you don't know if they're going to be truthful to you, you don't know they're going to help you, but they're going to say yes, but you got to learn to take the punches are not, you're not going to be successful and no one is successful by just going through an easy life and doing just unless you are like you know, an heir to something, but most startups aren't like that and you spend a lot of your time just doing the work yourself or having to go through a really rough route. Some people have it easier because they have a much more connections, but oftentimes it's always like that. It's a punch in the gut every time.

Interviewer: So do you think that's the most important? To be well connected?

Respondent: Yes. You have to be well connected and is also resilience. You're, you're not. Marcus was just telling me the other day, he was complaining to me. He was like not complaining that he was like, why do you know how passionate about this

project I am? I've been working for you guys for free for an entire year and my dad has been like, oh, after you graduate you can come. His Dad is like the CEO or the CTO of a company and he was like, he, I could've gone to work for him, but I love this project and I like what it's going and I liked the team members and that's also where you judge character where at the beginning everybody's all in and they're in it for a cause and they're not in it for the money and they're not in it for the fame. And that's what you want in team member anyways, to, to do something towards a goal and be okay with living out of a, like, you know, I don't know the out of box or something, you know. But that's what... that's how it is.

Interviewer: So is that... when you look... it seems like it's really important for you the characters of your team members.

Respondent: Yep. Character is, to me is the most important thing, character and, and kind of honesty. Um, I've, I've had a lot of conversation with people where they will tell me one thing and then when we're in a group they'll tell the group and other thing and then the next day though the or the next time I see them they'll forget that they said something to me about something and I'll be like, wait a minute, this is not, you know, so, you know, so, so it, I need to be able to trust that I can work with you that at the end of the day, whatever we built, you don't take it and run, right. Or you're telling me something, one thing and you're doing it and it's not just like, okay, I'll tell you, I'll do this. But then like three weeks later and nothing's done. So competency is something that's important too. But I'd rather have someone who don't know how to do a lot of things, but is hard working and willing to learn than someone who's really intelligent but kind of dishonest in the way they are or sneaky. So. And I think there's a couple people where Marcus and I like, oh no, like we can kind of thing... but you have to balance that and also you can't, there's, there's also a fine line, right? Like there are people who are really nice, really helpful, but at the end of the day they don't add anything to the team. Those are the people you can't really. So it's a fine line and then you will have kind of some that you're like unsure about, but then I try not to like just at the beginning to say no and be like, all right, let's, let's give them a try and hang out and work together for a couple months and see what happens.

Respondent: And sometimes it works out where they actually exceed the expectations that you've actually had for them. Or sometimes you're like, okay, this was a bad decision we should have... And then you get into the awkward conversation of how do you, how do you cut the cancer before it spreads at. That's basically the term that we use, right? Yeah.

Interviewer: Yeah. And then I... I guess you have done a lot of stuff that you are not familiar with?

Respondent: Yup.

- Interviewer: So how do you... what is your approach to that learning something? Or... Knowing something that you don't know?
- Respondent: You google a lot. I Google a lot. I took a lot of entrepreneurship class here. So I did the Berkeley method entrepreneurship. I uh, took the bootcamp, actually I mentored in the bootcamp and uh, you know, I see myself in it kind of when you, when you do that because you see all these kids are really excited about their ideas, but then you see that they pick the team that's horrible and you know, it's going to implode within the next few days and it does implode and you see it and you're kind of uh, learn from it.
- Respondent: Um, I asked a lot of questions with, you know, people that I meet and I say, okay, you know, I don't know this topic, what have you can send me information and you do a lot of reading. Um, go to all the networking events that you can actually be very open to like kind of going out there, right? Like, if, if I wasn't open to saying yes, saying Oh, come to Denmark for two weeks or come to Denmark for a month and for a month and a half and uh, kind of just work with these students of mine that one summer, I think it wouldn't have worked out the way that it was because I would've been like, oh no, you know, so you have to be open to changes and you have to be open to just the unexpected and to do things that are out of your comfort zone. You know, I've never been in Denmark. Okay, I'm just going to go pick up and go and go. But then it's also your character, right? Uh, uh, to me, I, my personality is kind of like that anyways. But I love just talking to people and learning about people. So that's something that you kind of need. If you need someone in your team to be like that because you have people who are shy or some people who just want to build like you have engineers who just want to build a hardware, they don't want to have small talk, they don't, but it's, that's one of the important part of a startup is talking to other people who are not in your field, but also getting their input and having a conversation with them and saying is this feasible at the end of the day and yeah.
- Interviewer: Yeah. And... [pause]... sorry, I was just... I wanted to go a little into... It seems like you pivoted a little about what your goal is? Like that process was and how you made that decision. So it seems like in the beginning it was more the light and now it's more a light therapy and a more light. Yeah, I don't know what you can cal it.... A substitute for natural light. Like how did you make that decision?
- Respondent: I mean we still are going towards the light therapy as our like initial. Our ultimate goal obviously is... Like, um, I think that was the ultimate goal just because we know that at the end of the day it's not only about aging, but about general health? Everybody's health, right? And there's a lot of people who have trouble sleeping and it's because of a natural lighting and a kind of exposing themselves to exogenous light when they're supposed to be sleeping kind of thing. And being able to change that in the lighting system and allowing the brain to actually sleep when it wants, when it needs to because evolutionarily we go with the sun, right? Animals would wake up with the sun and go to bed at

sunset. That's why it's the blue light in the morning and the ambient light and night because you see sunset is kind of makes the sky orange.

Respondent: Um, and so I kind of had the ultimate goal of why can't we get back to our primitive selves, but eventually, you know, training our brain to, to do what we're supposed to do and through evolution. And that's, that's more because I'm a researcher and I'm a biologist and I like it that way, but I also think it's beneficial to, to not just have a therapy just with one group of people. I'm like, why do you wait until you get the disease or until, or until you are sick and dying, why not fix it or even have your body be healthy at all times? So that's why.

Interviewer: And that seems like a really good point. So why didn't you start with it?

Respondent: It's very difficult to start with that because you can't really, um, targeting healthy patients now, like, you know, the also limitations of getting yourself out there, right? Everybody has a monopoly on lighting already. And getting through that is going to be very difficult. I'm also, for us, you have to determine that your light works first to do anything first. So I'm going through with the original goal of Alzheimer's that you do know that this light should work. It should work to improve kind of the oscillation in the brain. So what we're doing is we're testing it in young and old right now. And then there's a lot more funding in, in trying to help with the Alzheimer's side than there is funding to. Hey, how do we change the light above you?

Interviewer: But it is the second one you want to do now?

Respondent: Oh No, we're still doing the Alzheimer's. Just the ultimate goal, right? Is eventually.

Interviewer: I see.

Respondent: So right now we're still on the therapy side. We're still doing that no matter what. The ultimate goal eventually would be to implement it into the lighting system of homes or even hospitals. But now it's still a therapy.

Interviewer: And that is because of funding as I understood?

Respondent: Yeah, it's funding and also research is much easier to do on volunteers who will do anything.

Respondent: And also you can't really just, you need a lot of permission to change. I mean not really because I can just put the light bulb above you and you can even notice. But at the same time it's like, how do you know? Because you can't tell people, hey, tell me how you're feeling. You know, without going through all the clinical stuff. So right now we're going through the clinical phase with the patients first and I think it's much, it's much better of a goal to to to be able to

go down that route first as a hard, long, hard route, but it's a harder route to go and try to change infrastructure and change buildings because it costs a lot to change the lighting system. Whereas if you have a light therapy system for now and eventually if there's new buildings being built then you get contracts for that, but you have to be as a company large enough to do the work.

Respondent: So you see the Alzheimer treatment as more of a stepping stone?

Respondent: Well, I think that it's a... it's not a stepping stone, it's more a discontinuation of learning how does this light work and all the time by patient and can we prevent it from happening at all. So it's still an Alzheimer sleep goal, but to learn more about it and learn if you can even have any effect first, do the clinical study, do the light therapy where you have to hold it in if you don't mind staring at it. And then going back and seeing, okay, we have that, would it work if you just extend it out because you don't, I don't know myself if I just kind of sitting below it for a long period of time can improve. So you rather do so many that you know, might work for an hour than not go into something like this where it might take years of sitting below and I think 10 to 15 years of following somebody progression, right. Um, the, they eventually develop Alzheimer's or not, or later sooner. That takes a long time. So that's a has a much longer route than it is to look at someone's cognitive improvement.

Interviewer: And is that the... So the first... the... if it works on the Alzheimer patients. Proving that point, what do you think are the most important steps to reaching that? You mentioned the clinical study...?

Respondent: Clinical study? Yeah. Yeah. Uh, so having kind of following the patients for before the light and then after the light and look at MRI, so brain activity during some cognitive tests with them and saying, okay, how much do they remember before? And how much do you remember after there's a set of portfolio already in the psychology and in, at the hospital that they use with their patients to test how much patients have regressed or improve if there's any, most of the time they don't improve. So we know that if it's an improvement, it's somehow it has to do with the light because most patients, there's no cure, there's no recovery, they just go down, but it just declined. Um, and so that's the initial step that's going to be about two to three years that, um, I mean it'll take us to one to two months to initially do it on healthy, young and old.

Respondent: Just look at to see if the light works to stimulate anything in the brain. And then gathering, um, patients is going to take a long time because you have to go through all the ethics committee and you have to go through all the hospitals and you have to go through APA, which is basically a privacy compliant for the patients in the hospitals. And as well as. So then there you have to determine how secure is it that they're able to, the information doesn't get out there, right. And then you go into starting testing them and following them and that is going to take a couple of months because you want to stop the light, start the light, see how they improve, stop it, see if they regress and started again because you have to do multiple runs of it. And then after that we're hoping that we can

start collaborating with hospitals or even a senior citizen, a senior facilities to to see if we can implement the system and then later on probably probably commercialization of a product, but that's going to be like 20 slash 21 or something like that. Three years.

Interviewer: And when you say implement the system..?

Respondent: Um, so implement the system like apply it to senior homes where now patients should have an hour of it every day and that they should kind of time. It's whether they have an hour of it during their activity or something you know, is.

Respondent: So previously you mentioned that it was also important that the patient we're comfortable. What do you mean by that?

Respondent: So the original light that the MIT study is that it's flickering and so that's annoying. Um, it's uncomfortable in terms of they don't have to strain their neck. They're back to, to actually be exposed to us. We want something that stands alone, something that. So oftentimes they, the bright light, they can be light sensitive. So you want to make sure that, um, it doesn't hurt their eyes in any ways. It doesn't affect their cornea. There's a lot of things that are involved because some of them have cataracts when you get older. And so we might think is a really bright light. They might not even think that's bright at all because of the amount of light that's going through their eyes is not same as ours. So then you have this like, um, it's like a chicken or the egg game. You have to go through and say and have the ask the patient and a lot like, oh, how do you feel? What the light is this too much sitting here, too bright for you? Does it make you feel dizzy? You know, there's a lot of things are involved where you want to make sure that at the end of the day it's the patient's wellbeing that is being upheld, not just your, you're doing your research right. Ethically, you have to make sure even though it's not invasive and patients that have gone through much more painful things like side effects and medication and no result, I still want to make sure that at the end of the day that they're comfortable and it doesn't.

Respondent: We have to give it to them at a time where it doesn't affect the circadian rhythm where they can't sleep at night. Um, so those are, there's a lot of things you have to consider and you have to talk to experts in the field to make sure that you get right, but you probably won't be able to get it right for. Because everybody's different. Their sleep times different times different. So being able to individualize the product and the timing of when they should be exposed to the light is also important.

Interviewer: And how did you learn that? That it was important? Like the physical strain and it could be uncomfortable for the eyes.

Respondent: Uh, I'm a biologist so I read a lot. I read a lot. I, I also took a lot of a biological clock classes and a circadian rhythm classes and we do talk about the eyes and

we, we look at how much light the eye can get and how it can affect the brain and sleep. Um, so that's what for me is that I already knew those things. So it also the physical strain, the physical and the physical strain. Yeah, it's, it's also we work with animals and we know how uncomfortable they can be. They have to also questionnaires, right? We ask nurses who we asked senior patient care, people who tell us like, you know, oftentimes they have back problems. I can't sit here all day, so you have to have like a leaning chair that's kind of like nice and maybe have like either a light above them or if they're doing something already like writing, um, that's more comfortable for them.

Respondent: The initial study will probably put him on a chair and just have like a light above them so they don't really have to move or do anything. They can just sit there. Um, so those are, except sometimes like, I mean even yourself, right? If you sit at a chair, it was an uncomfortable chair. You don't want to stay there for a long time. So just learning from your experiences and, and, and knowing that they're, the eyes is different, right? Like your blue eyes actually, um, take in different lights in my dark eyes like I had taken. I took it more blue than you do because you're blue is actually being reflected. So how much more blue do you need in order to get the beneficial, a wavelength to be able to penetrate through. Right. So that's, you know, so sometimes having blue eyes is not a good thing and sometimes it is because you don't want to be exposed to too much. So it's a balance.

Respondent: I see. Okay. So your process of discovering that was that you knew something from your own background in school and then you sought out experts, as I heard you? And then you kind of made some design decisions based on it or at least some...

Respondent: Yeah, same. So you have to just make some design, like a minimum viable product and then you go and test it and you go as well. We're going to go ask the patient like how do you feel? Also a lot of times patients can't tell you or the customer can't tell you is it's the family tells you the right? Because they're like, oh my mom looks uncomfortable doing this or that. The person who's the caretakers will tell you they are not. They don't want to use it because it's uncomfortable or they don't really think or they can't sleep at night now because they can't use it. So those are, like, we haven't gotten into doing that, but those are some of the questions that I want to have beforehand for the caretakers and say, okay, are they sleeping at night? Um, how, how are they feeling after they use it? Do they, like it, is it comfortable, do you see any kind of side effects from it kind of thing. So you have to have a questionnaire for someone who's cognizant enough to tell you. So that's, that's also some of the things that you haven't taken inspiration and I've also been doing so many experimental sample questions for my classes and my students that me, I ask questions all the time when I do an experiment. Right? So sometimes you get lucky and you get people who will have already been doing this with senior citizens and they can tell you like, I wouldn't do it, wouldn't do it this way, I wouldn't do it that way. So yeah.

Interviewer: So the patient... or your target patient population is some... is patient that are not cognizant enough?

Respondent: No it's early. So there they're still cognitive. But um, sometimes you will get patients who aren't cognitive enough. Um, so then their family have to tell you, but um, if you get, if you, most of the time what we want is just early stage where they, they're forgetful so if they're forgetful they won't be able to remember how it felt. So you still, you, um, for us we're trying to develop maybe like a software, an application to after the fact that they're doing it, they can click which makes life easier for them so that they don't have to wait until we come back where they can just sit there and answer some stuff and be good. But uh, we have a software guy doing that now. Yeah.

Interviewer: So have you already been out trying it on patient, like you're a product prototype or you're planning it now?

Respondent: We're planning it now.

Interviewer: Okay. And what is the, what do you think are the most important aspects in going it in going out and trying it?

Respondent: Getting permission.

Interviewer: Yeah, but I mean forgetting the... I mean you can get a lot of data from such... how do you ensure that you get the right data?

Respondent: When we talked to people who are working with Alzheimer patients and we say, okay, what are, what are some important data that needs to be collected to make this significant? Um, do you think this test is necessary? And I think we've had many meetings with a room full of doctors and physicians and professors who have countering idea. But then at the end of the meeting we set on like, okay, we can't do everything, but what are the most important things that we have in terms of funding now? And at the end of the day they're like, okay, let's do this, this and this. But what are the limitations of doing it right? Because an MRI, you have this machine that the magnetic resonance, if you put a chip in there and the light, it's gonna mess up the entire machine and the reading because of the radio waves that it's sending out.

Respondent: So we had to go and ask another specialist or we were thinking of having a fiber optics 20 meter. If fiber optic like strand to go into to the going through a hole in the wall to now send the light in, so the machine, our light and our trip isn't in there, so there's no radio wave and it can do it. Um, we were in the process of building that and then all of a sudden I'm one of the professors, she was like, oh, I have someone who builds something similar and maybe you can talk to him. And he already built it with titanium bolts and everything because that's what the machine has is titanium metal. And he already had a helmet for them to sit still. All we needed to do was add the fiber optics, which was lucky for us. But if

you run into a problem where now you're messing with the machine and getting permission, it's gonna push you back like six to eight months.

Respondent: This guy already had permission to put his machine in there. So now it's only pushing us back like a month, which is, which is great, but, but you have to expect the unexpected oftentimes to say, you know, you tell people, oh yeah, we'll be doing this in six, eight months. You might be doing it in 12 to 18 months. Sometimes it works out, but you can't get like, sad if you don't get it done because it's a lot of rules and regulation, especially working with humans that you have to follow to, to do these clinical stuff. So we're kind of in the small, like lucky this guy built something and he just wants a paper out of it to validate kind of thing. So we're going to use that in June actually, which is nice for us. And uh, yeah, we'll test it on, on these patients. But it a lot of steps to getting, getting the patients because you have to find people who are working with Alzheimer's patient and then they have to put into their protocol a new kind of experiment and then you have to ask permission and then it goes back.

Interviewer: But... And so that is more the light testing that, but I was thinking more of the comfort..? How did you... how did you test it? Or are you working on testing it?

Respondent: Oh, that's kind of simple. We, we kinda just had a prototype and then we went around to people who are older, just older people, not necessarily like Alzheimer's patient because you do, you do know that when they get older they have some similar kind of regression of their eyes, some discomfort or the body and sitting wise and uh, and just put it in front of them and we took it to, I think Dan took it to like, um, different facilities and home and ask them, oh, what do you, how do you think it looks? Um, does, does the light too bright? Some of them are like, oh, that's kind of weird looking Taj Mahal thing, you know? Uh, some people are like, oh, I can't see really the light. And you're like, wait, it's so bright, you know?

Respondent: Um, or some people will be like, Eh, I would, I wouldn't want to sit here just staring at this thing all day. Uh, and you know, so you get, you get a lot of questionnaires but it's a lot of surveying so it's more of getting to know your customers and getting to know who your people, where you're selling this to at the end of the day and seeing if what they think of it, even if it's something that is your... it's not your final product, at least you can go and get a gauge of, of how people feel about it and how their discomfort is and what they would say. Okay. It's too high, it's too low, it strains my neck and those are the kinds of things that you at the end of the day and talk to them about or just ask them, okay, would you be willing to sit in front of this all day? But if I tell you it helps you be more focused or you know, and some people say yes, some people say no, but you kind of get an idea of how you want to do it.

Interviewer: You just mentioned that it was really important the team that you had. So I wanted to know if we could just kind of draw up the resources. You have both your own background, which is a neuroscience...?

Respondent: So my background's neuro science and I do kind of a endocrinology circadian rhythm stuff. So looking at hormones and how changes in the hormones can affect the body, uh, how sleep can affect your hormones. So it all ties together. Right. And I kind of have, I started doing, you know, things are outside of the scope of my knowledge was just kind of building and doing entrepreneurship and uh, just randomly learning about things. So that's, that's my scope of, of knowledge. And then we have Marcus who's a physicists, physics, um, engineer. Um, and so he was quite a, quite a brilliant guy and uh, so he does, he can build things and he can do the research and he can do the math or the algorithms of everything.

Interviewer: And your. Sorry, continue.

Respondent: He's a, he understands light and LED really well, so it's good to have him around. So, and then we have Gustavo who is just a hardware guy. He can solder things, build, take apart things and learn about it and recreate it, which is great because sometimes we're like, okay, how does this light bulb work? Uh, you know, who else do we have right now? We have Dan who does all the survey work for us, so he goes out and he does conduct the interview with like um, you know, he does interviews with me he uses what Marcus and say, okay, what have you been doing? How do we improve it? And he goes to companies and say, how much does this cost? How much would it cost for us to buy this? He goes to um, senior care homes and ask them like, you know, if we had this product, would you be, how much would you be willing to pay kind of thing. So he's kind of like our survey guy and they're kind of research, but he does the research on what is feasible out there and what are people looking for. We have Stephano who is...

Interviewer: And what is Dan's background?

Respondent: Dan is a, I don't remember. I think he does. He does some engineering work, but he, he mainly does. Um, I don't know. I asked him the other day, I don't remember.

Interviewer: Okay, that's fine.

Respondent: Stephano is, um a business guy so he does all of the market market research and looking how we can enter into the market. Um, he's looking at a different partners that we can have. Um, what are the limitations of the product? What kind of, how do you say it, what kind of, what can you add to the society kind of thing. So he does all that research for us. And then you have Nikolai who's also a, he, he tested and validated and make sure all of the system works. Gustava builds it. And Nikolai tested three tests and make sure, like all the, all the circuits are running well, all the connections are on there. Um Henrick is our computer science guy, um, he basically built the circuit board for us, so he built it and wrote the code for it so that we can just press a button and everything would turn on this way. Everything will turn out that way.

Respondent: So he's pretty good at what he does. Um, if you look at all our trip, it has his name on it and then you have who is the software developer. So he's going to develop the android software for us. And so, you know, do I think the one thing that we're, we're kind of missing is the product design and a salesperson in that aspect because we have basically the research person, the development person and the technology, the kind of specialty. And then we have all of our board members who are kind of people who are in, who are know, like Rasmus is an angel investor, but he works in the pharmaceutical companies for a long time. And he, he also had been doing like entrepreneur work. So, uh, he kinda gives us an in of like, how do you negotiate deals, how does patent work? And, uh, how would you go about, you know, the insider information on certain things.

Respondent: What else do we have? We have Gaeta who does MRI that she's a leading researcher that's allowing us to kind of. She's also in the advisory. Yeah, she's on the advisory. We have own who does the endocrinology, um, and we have Camilla who is the cognitive function person, so she does all the questionnaires and make sure how, how does this translate from MRI, but how does it help you cognitively can you next day or a month from then are you better at remembering? Is your cognition better? Kind of thing. So that's what Camila does. Uh, who else was in that room?

Respondent: It's hard. And my professor here at Berkeley, he is, he does circadian rhythm and how it affects neurodegenerative disease and reproduction itself. And then we have partners such as like, um, Skydeck who is going to be their accelerators, right? So trying to use as much resources. And we have here, this was harder center, right? Just all the people that we can find to, to help us out. We kind of a, we should look for them and kind of talk to them. They might have different differing opinions, but it's just nice to have as many people as we can to have a conversation about it.

Interviewer: So... and then how do you facilitate these people and like if they have different opinions?

Respondent: Um, you sit down with them and you have like an hour long conversation and kind of, you know, I think the Danish side, like these people over here, they, they all kind of studied the same thing and um, they studied the same or not studies, they're all along the line, have they work on different things, but they all know somewhat on cognitive function.

Respondent: So get it as far my cognitive function. So then they're all like leading industry people on the brain and how we should go about and test it. So then those are the opinions that you want for that side, the clinical side. Whereas, you know, the Berkeley side is more, um, how do we take this, this group and how do we build and accelerate it as a business savy or those kinds of things. And then these are more like Open Entrepreneurship in Denmark is similar to this, like, you know, do we link it all together and just building a network basically have everybody that can, can kind of give you some sort of input in a way. Um, and then just making sure you're talking to everybody. And in a lot of times it's been

really nice where they are very excited about it and they can say, okay, I know this person, I'm not a specialist in it, but I know this person. So having a great network is something that's fantastic.

Interviewer: And how often would you say like these advisors, how often do they input to the project?

Respondent: All right now probably. But yeah, in general in general, uh, depending on the phase that you're at right now, we're on the clinical phase. And so we're always talking to the researchers and the hospital people. So once or twice a month I would email them and say, hey, you know, we're in this process, we're moving along. You always, even if they're not doing anything in the project at this moment in time, you always want to keep them in the loop because you, you never want them to lose interest because, you know, if you don't talk to them for a month or two, they might think this isn't going anywhere and they move on to do other stuff. So you always want to be like, hey, you know, I'm just checking in with you. This is our progress. Um, I know we've spoken before about this, but we're not at that stage right now but just want to let you know that we're keeping you in mind kind of thing. So it's, it's also like knowing how to work with people and then knowing that you can't just go to people. So it's a common courtesy right and if you, you never want to burn bridges. So around two times a month I would email and say, hey, how's it going? I just want to check, check, check in. Um, these are some of the things that are going on or you know, because I'm always in Denmark so I'll be like, hey, you know, I think we should have a meeting as to what our progress is and what our next steps are.

Interviewer: And, and this is more the daily team?

Respondent: Yeah.

Interviewer: And are they all full time on the project?

Respondent: As of right now? Yeah, they're all doing their masters thesis. Okay. So they're all full time trying to get their masters thesis. Me and Marcus are probably the only two who's uh, maybe other people, other people we haven't really talked to but you're going to be full time after this and then we'll just move forward. I think they all want all want to continue, but um, some of them are probably gonna end up doing their phd on it. Yep.

Interviewer: And how do you think... how is it having people doing like working on the project as part of their master thesis or Phd as opposed to full time?

Respondent: Um, I mean it gives you while they do their masters, that kind of thing. Especially even if it's in Europe, it's kind of works in your favor, right, because there they are getting a degree for it, so they're putting a lot of their time into it. At the same time it doesn't, it doesn't affect because especially during a

startup you have no money unless you have some kind of valuable data. So they're generating the valuable data for you and then you're able to go and say, okay, now we have money and if they want to they can step into the company once it has or they can take a phd and they're still getting paid for it. It's just. So it's easier on the company. In terms of funding, Gustavo, he's been doing this just for free and not even doing a master's thesis. He's just working on the project. Um, and those are the kinds of people who we wanted to take into the company. Anyway. So finally I think this month we hired him on as an employee of the department, sort of like. So we're paying him through the proof of concept funds because we know he's been doing this for so long.

Respondent: He wasn't even part of the class last semester, but he came in like, you know, every day from eight to 9:00 PM pm just working, so that's a good team member where you know, they see the value in the project and they see how it works, but it's also if you notice that we're all really good friends and we all like have fun while we're working, so the connection is there. Whereas if you have team members where you can't work with them, it's kind of hard to, to, to want to go to work everyday and not get paid.

Interviewer: Right. I see. And you mentioned that you were missing product design..?

Respondent: So product design to make it like beautiful. Right now we're just making it work and then we're missing sales eventually. Eventually we'll have a salesperson, but that at this stage and time we don't really need a salesperson because we're not going into sales, but product design is probably something that we have to look into because in the next couple of months if we're going to go test it, we want to design something that is again, comfortable and easy on the eyes and if someone would want to just also, there's a stigma of like people were like, okay, I'm sick so I'm going to use something that you don't want it to stand out as a treatment. Right. You just want something that is kind of normal to look at it and. Cool. So yeah.

Interviewer: So how do you then approach those activities where you don't have the capabilities within the team?

Respondent: So usually we ask around, so, or are we, we look at like courses where [future co-founder] has courses or here in Berkeley, I'm in the invention lab and I'm just always scoping out people who are good at doing design and just kinda have a conversation with them first and kind of talk to them for a couple of months and you know, eventually if, if they're interested in what I'm doing and I'm interested in, in their design work, they work out. That's how it usually happens is that you have a conversation and then you, they seem really interested in what you're doing because you can't just ask someone, hey, you want to be part of a design group, people aren't going to be automatically interested in, in your company. Um, it's more of when the two stars align and they'll go, right.

Interviewer: So, so, so your approach would be to find someone to do it?

Respondent: Yeah. Yeah.

Interviewer: And what would be your assessment of a good person to do that?

Respondent: As someone who isn't like constraint by a certain... Some people who do design, they just have one vision of doing it. Like, I have a friend who only liked to design kind of rustic kind of field, so like doing everything with would kind of, I'm kind of like southern homes kind of thing. I want someone who is like, okay with change in like five or 10 months because sometimes you will get frustrated because they designed something and you're like, oh no, sorry, we pivoted to this. I'm so flexible. Um, I dunno, I haven't really found a design person. So it's kind of like of like when I find the person I'd find the person I feel like is, oh, you don't really have, like I don't really necessarily have an idea of how I want the product to be at the end of the day I want it to, I know what I want, where I want it to be in how to work and how it looks like sort of. But you know, if it happens it happens.

Interviewer: Yeah. Yeah. And why do you think it's important to have... I'm sure you could read a blog about how you do design. So why do you think it's something that you need to designate a person to?

Respondent: Uh, is because at the end of the day I can't do all things, you know, like I'm sure I can, I can 3D print some stuff. I can, I can design some stuff. Um, it's just, I have to use my time wisely. Uh, especially I'm already kind of trying to get investments, trying to do clinical studies. I'm kind of leading these guys, so the right directions and where we're moving. So I'm learning how to delegate, actually use something that I had to learn because I used to be like, oh, let's just let me do it. I'll do it, you know, but you will get drained and you will get spread really thin.

Respondent: So having the someone to just kind of already know how to do it and don't have to use this because I can probably spend like a month to do something to someone who already know how to do product design does in a week. So also efficiency is important where I already don't have enough time so it might extend the amount of time it takes me to do something and learn something. [inaudible].

Interviewer: And you already do have a prototype, right?

Respondent: Yeah, we have a prototype.

Interviewer: And why do you think it's important that it, that that goes... It seems like that should go a lot into the design of it as, as you would have a designated person. Why do you think that is important?

Respondent: It's always important because people will always judge things by their eyes. So it's more aesthetics. Aesthetics. I mean we have a really pretty theater or now

or it's a panel. Um, I really like it. Um, now we just got to make it more a kind of consolidated because we have wires hanging out and everything. So Pi, a design person can say, oh, we can hide it somewhere. It's just much easier. I mean, I can probably figure that out, but um, I just don't have the time to do it, so I might as well have someone else do it. [inaudible].

Interviewer: Yes. I think that was it. Okay. Thank you so much.

CASE 2.2

Respondent: We twice use modulators to stoppeldor or even slow the progression of Alzheimer's disease. We are team.... I said at DTU, we, we're team at around eight students at DTU right now. We have our own lab, our own equipment, and we pulled out own electronics and software. Um, in relation to the business side, we have a couple of students from each new management works on the strategic and technology management part of the FDA. I follow a small enterprise... The plan is so far to a startup in August where most of us finish our master degree, so a startup.

Interviewer: And when you say startup, is that founded? The company..?

Respondent: So we already have four team members for Co-founders in place and it's basically making the CVR number and uh, after we spent the research money we can start looking into other kinds of money gets spent on the various projects we have going.

Interviewer: And so you mentioned four co founders..?

Respondent: Yes. So, uh, the plan so far that the, my, my Julia will stand in as co-founder and CEO of the company, myself I will be CTO of the company and also co-founder and then we have just co founder and investor and we have hospice as invested in co founder. Then we have the initial people. Hopefully we have, we have a couple of people already involved in the project that uh, that will also be part of it.

Interviewer: So what kind of role will those people have?

Respondent: That will, that will, that will depend on the problems we have to solve at that moment in time. But, but it will probably be in electronics and software, but they will get the business pretty much covered up by [co-founder]. Yeah. And Eh, and the neuroscience. But we still have some neuro... neuroscience part... but we are slowly developing relationships with KU to have the correct.... um. You could say diversity in the board of directors. So the board of directors, you basically need a team of scientists, so like three around... three people. It has to be people that know about Alzheimer's, like the, the really nerdy parts about Alzheimer's disease. But it also has to be what trends are going on at the moment. So it's two times, two different types of people you can say who knows about what's going on in relation to technology and pharmaceuticals and also people who knows to the tough science. If [inaudible].. in non science team you can say which consist of people with knowledge about innovation and how do you make a startup, how have you found money? You get money for the right amount of equity and stuff like this.

Interviewer: Yeah. And how did you get involved in the startup Marcus?

Respondent: Um, basically [co-founders] they have a chat at UC Berkeley and they came home. Nothing was really going on with this idea they had. So they got an idea of how you can use some new research to stop the progression of Alzheimer's disease. So you. So I found this and he was like telling me about this awesome project. He was trying to start up, but no one was building anything for him. So he was like, I have this older ego go there. They had just had it. And then I started the 3 weeks course in June 2017 and one

of my friends Henrick came and we, uh, we just, uh, matched and we made a nice prototype of that year and technology wise it was a proof of concept, but of course when you have to show something, you also had, you need a medical proof of concept which is much harder to get, so you can make some nice technology, but you have no idea where that works in that you're basically right now you can say taking this proof of concept made me a better. And also try to put it into the medical context. Yeah. Clinical trials and pilot studies.

Interviewer: How would you describe the reasons that you joined the startup? Your personal reasons?

Respondent: Personal reasons. I love to learn new stuff. Um, I haven't had much experience in the startup environment, extremely theoretical physicist and I didn't actually know much about it. So the personal interest, like it kinda was also to learn a lot about electronics and uh, and how you like applied it to... So I know a lot of theoretical stuff and how many ideas about how that stuff works, but I'm learning a lot about applied technology.

Respondent: And also with the startup environment and all these challenges that are coming with that. How you apply for money. Yeah, I, there's a lot of stuff. You have no clue how much time it takes before you actually do it. We also have struggles with like protocols and human trials and all this stuff. That's a lot of things. You only find out how long it takes after you're in it.

Interviewer: Okay. So just to be sure that I got it correctly. So what I hear you saying is that you joined it because it was a good learning experience.

Respondent: Anything in life has to be a good learning experience. Yeah. Yeah. It's fun. I think it was, I joined it because I want to improve myself and, but also do a good job with the, with the technology. And it was a quick business case. It was a good team. Yeah. The reason that you get... a, a better question is maybe why did I continue?

Interviewer: That's a good point. So why did you continue?

Respondent: Because now I know... I know... if it was only a three weeks course... only a three weeks course then it will be like why did you do this? But now I have been through three weeks, all of my summer holiday, my master project. So. So as long as that you are surrounded by good people and nice people were also quite competent so that's, that's also good.

Interviewer: So that aspiration that you have to have the startup as a learning experience. Is that something that influenced your work?

Respondent: What do you mean?

Interviewer: Like maybe some of... maybe decision making... or...?

Respondent: Yes, of course. Well, Eh, Eh, uh, that's a, that's A. Yeah. I have to think about that question. Oh, can you repeat that question? If it influenced me..?

Interviewer: It was more... Um, do you think you think that, you know... that you have, that you... the fact that you're wanting the learning experience and that's one of the reasons why you joined the startup and now you spend so much time working on it. How, how do you think that aspiration influence your work with the startup? Like do you think you would, if you didn't want to have the learning experience or maybe you can see that you act differently than in other projects or... does it make sense?

Respondent: Yes, it makes sense to me. Eh? So the answer to that question is uh, in my, my, my... now you say in relation to other projects. So, uh, I think I've always did whatever I did like after, like maybe high school, somewhere around there has been some kind of interest. So it has always, any project I have made has been of interest. Okay. So, uh, so it's a, but I don't think you want to work very hard if you don't do it by interest. So it has to be, it has to be some out. I'll put like you have to learn something that's boring if you don't like it. [inaudible] maybe have to get up very high salary. You have to learn something new or it's not worth the time.

Interviewer: So do you ever come across any tasks working with this startup where you don't learn anything new?

Respondent: Oh yeah. Oh my God, I do. It's terrible. But you have to do it. So. Okay. I have, I have an example. We are buying a lot of stuff. So I, I get a lot of packages because we are building hardware and like, uh, like uh, last week we had a package that was delivered to the address. So it was the supplier who will put the wrong address and I had no clue because these new oracle system. Yeah, I was just calling like six different people and writing mails and the looking through all the mails and where could this package be? And it took one and a half hour to locate a package. Yeah. Finding out that it's at DTU building, 266 to happen to you and it has been there for like a week. Told me and it's all because of this. They put the billing address as the delivery address. Yeah, yeah, yeah. It's like you find out that this is like a small, small mistake, but then then you really feel like I just wasted like one and a half to two hours. Just the locating one package. Yeah. I get three packages a day or if I should do that with even I would have no life. So sometimes you just have to take it like it's basic stuff. It's extremely basic. Anyone, whether you have to do it. Okay.

Respondent: That was a personal experience, I don't know if that's what you are looking for?

Interviewer: That's exactly what I'm looking for.

Interviewer: So in your opinion, or how would you describe the success of the startup?

Respondent: The success of a startup?

Interviewer: Of your exact start-up!

Respondent: Yeah, I think we... success should not be that we... it would be very hard to claim that since you say cure Alzheimer's because everyone has failed despite putting billions and billions of dollars and more maybe into it trying to stop or cure Alzheimer's disease. Everything has failed this equation. So if, if, if that was my success and I would not be here and the success is because it's so, such a low chance even say. But of course there's a chance. Which is why I'm still here, the success we should be defined more like the amount that you can say, I will not say greatness. The um, you can say the greatness of the team we put together like and the um, the amount of work and the quality of work. Yeah. The network and the gap between universities we generate.

Respondent: You can say we're filling out the some kind of gap that is between the collaboration between universities and companies. So we collaborate the podium racing companies but also setting up cooperation between countries. Yeah, California and Denmark. So there's a lot of success criteria is of course it will be a huge success if we cured Alzheimers disease, it would be in the news. So that will be awesome. Everyone would be famous and that would be a huge success with DTU as well. But the... but I think, I think it's somewhere in the middle. We don't, we don't have to, don't have to save the world before the success. So the success, it's also about learning. So in the next project... if this doesn't work then we'll do another project, something else. But you learn a lot and in the end it's.... You achieve that. Is that is making you who you are and what you can do in your next project. Yeah. So then now we do this project and we'll do it the best we can.

Interviewer: Yeah. And I, I guess that correlate with your reasoning for joining this start-up that you wanted to learn something.

Respondent: Yes.

Interviewer: So have you felt like a, that has changed over time that...? You also mentioned collaboration and the learning experience you get out of it as a success in itself even with... um irrespective of how the, the Alzheimer outcome will be. Is that something that have changed over time?

Respondent: So it has changed. Yes. But the learning aspect is still there. Yeah, that has been the most of my life. But um, it's very interesting. Yes. I think it has changed. It's now it's, it's, it's also um, it's more entrepreneurial interest so it's more like becoming an expert in entrepreneurship both both like a project management and um... like, oh, technology management that we are pitching here at DTU and KU you would like trying to collaborate in making some, some pilot test on some people that can you and measuring this and that. So it's like there's also some other interest in like how does this work out? And that's also the whole idea about it. You could say saving the world or that's also awesome. It's awesome to have an idea that can change the world, but that's you could say that's also, it has changed at the beginning of as much as interesting, but now we have something that might change the world which is quite, quite intuitive in some way or the other.

Interviewer: So that goal; changing the world by curing Alzheimer's. I know, I know, I know you said it was a little farfetched, but still what... how would you describe the most important steps to reaching that goal? To curing Alzheimer's?

Respondent: It's a good, a good, good team. It's a good timeline. Then it's securing funding. Yeah, that's three things. I think the team is most important. Yeah. And also like, uh, yeah, be able to work hard, work a lot and work hard, be smarter, smarter. Yeah.

Interviewer: And how would you describe the most important activities you're doing right now in the startup?

Respondent: Mm, most important activities. So we have a lot of activity. What is the most important part? Just to sum up what we're doing? Yeah. We, uh, building technology, if you can say it because the whole project... um project that can be used, be used to maybe slow down the progression of Alzheimer's, but we will be also doing science. So while we are doing.. building like this platform of software for a product that can be used by people, they also building an entire setups that can, that can trace how... how all different kinds of lights. Uh, is doing something with your brain, how it interacts with your brain. Um, and at the same time we're doing that, we are actually working on another setup that is for a pilot test at KU. and it's. Yeah. And then we also have a project right now working with an insidious screen to see how we can implement our light into computers.

Respondent: Which also quite interesting. Um, because, uh, you can say our life is a white light source. So in principle you can put it straight in principle could put it into entity risk screen or computer screen. So at root we'll see how that works out, but we also do, this is the most important part of, of, of only thing we're doing. So it was, so you're going to get. I'm working mostly on the development of technology I'm not talking about the business. [co-founder] he has a view of the business plan.

Respondent: So this is my main activities are the most important part here is the pilot test at KU. So this is what we're focusing on now. So we we're doing magnetic resonance imaging off firstly us some students and then in the future patients as students to see how different kinds of light works in the brain with different kinds of waves in your brain and also see how these waves in your brain, the oscillating, how they indicate is quite interesting. So this, this, this. This is the most important because we need to have like proof of concept. You have to say that our light, that's the same as what the MIT study originally performed in December 2016 when it showed... studying results in mice. We have to show that our light source can do something similar in humans.

Interviewer: I see. And so that is the most important activities. Now is there something that has changed over time, is that, has that always been the most important activity?

Respondent: So of course it has also been the most important activity before, but through all the development of the technology has to be done. Yeah. So one thing is that you think it is... that you have this most important activity, but to reach that most important thing, you have a lot of small importance things. So we have these small baby steps so then has to find it easier to find the right people, electronics, all this stuff, validate that your

light is. It should be. So stuff like this, setting up collaboration with the people who has to do the test, find the rooms, find the money, but it tests finding the location of the machines. Go through security tests to get access to machines, find people who know how to operate the machines. And so there's all these small steps. Before you can do what is most important.

Interviewer: I see. And it seems like a very cumbersome task having that study. And how did you. Did you know how, how, how would you describe the process of a getting that in place?

Respondent: To get something in place like this. It's about, it's about knowing people and it's always an advantage of since you have... so it basically Paul Michael and [co-founder went] and talked with them and they think they can then tell that they have these students, they have built this light source and they would like to test out this light source. Then they have told about the light source and the get in most schools. It was interesting because... i'st interesting because it was something new so it's interesting to receive. For any scientist out of something changes. How does the biology. Is that some chemical changes that there's some Beta amyloid that is reduced in the brain if you put them under the simulations? We have some kind of new simulations as much shows to do anything normal. No one is testing at this point. It was. Yeah, so that's why it's interesting for her as a scientist, but she also, of course, she also interested in perspective of curing Alzheimer's. Stopping it. Yeah. That's how you get something like that in place. It seems like a long process. You have to know people, scheduled meeting with them and then go talk with them.

Respondent: That is good. If you have some background people that will execute for them. Yeah.

Interviewer: So exploring this study. I guess it's the first time for you doing a study like this?

Respondent: Yeah, definitely, definitely. I even... that we should through the study, but we have to do everything now. We though we should only build the technology, but now we are also doing the study.

Interviewer: Okay. I see. So all of these things, I would imagine it is... It's a quite new for you being a theoretical physicist.

Respondent: Yeah. It's fun. Yeah.

Interviewer: And how so then how do you learn about this stuff?

Respondent: Uh, I just do it. It's like how you learn, you Google, you're asking people you know, uh, that's how you do, okay. You just, you just perform more actions per minute.

Interviewer: So how would you to make these kinds of decisions? Because I guess there's all sorts of decision making and figuring out what type of study and you know all of that. How would you describe the data that you use to make those decisions?

Respondent: Yeah, so that's of course very many... That's many times where you will in... you're confused or what did you decide to do? Yeah, that's the only way to do that is having a good mentor. Someone you can consult with when you are in doubt.

Respondent: It depends on what I'm in doubt about, then I'll talk to [mentor]. It's very easy for me because he has an office just... just next to me so I could talk to... If it's something else I could talk with Paul Michael and the consulting, I'm also. It's easier for some people I think to just reach out. I, I have an easier time reaching out to people so I, I can just write to people or mail or facebook. I have friends in all different kinds of areas, so if I need something about electronics or any these fibers, business I know the person to talk with and it's just. I just write them, consult with them. That's the easy way to learn. But else Google is your friend. Yeah, and Michael Holbæk. He, she, she has a lot of experience and it's also very good to try to memorize which people, this is a human thing, your memorize, which people have competencies in different areas and you do it everyday.

Respondent: I guess it should be an ongoing process. So every time you see a person you try to memorize, okay, this person does this, this, and he knows a lot about this. So, so that's good because then you just know who to ask when you adopt. Maybe it's not a proper you experienced right now but half a year that you would experience the exact same problem. So that's it. So I'll try to memorize problems people have experienced.

Interviewer: So what type of people do, what are their competencies?

Respondent: So, uh, we have a lot of people with.. how you can say it. This is a project which is very multi-disciplinary compared to normal... my physics projects... or actually a lot of projects at DTU. I think like we have everything... everything from electronic software, physics, bio science, neuroscience.

Respondent: What else? Optics... a lot of things. And doctors, yeah, nurses, but also business management, startup environment, should not under-estimate. So people from funding is for instance Michael Holbæk. So that's, that's, that's a guy we can talk with. People from neuro science that's Mai or Camilla who is a professor. Can you collaborate with people we could consult with? Electronics is a guy called Henrik or Gustavo be. People you can ask about Software Anders Bækthøj. If you know hardware thenr you can ask Bjarke. Yeah. You can ask all the startups on how they do it. I guess it's always fun to see what of people have done because then you know you're on the right track or you have to see, okay, you have to do this. It's always good to see what people have done. Yeah, that's always a good thing.

Interviewer: And how do you encounter those problems that you need help on? I mean, I would just imagine that it would be difficult if there's something you don't know then to kind of know that you don't know it, if you know what I mean.

Respondent: Well, that that's impossible. Yeah. Well that's kind of, that's quite as the contra-saying course you don't. How do you avoid not knowing? Well there's no secret answer,

Interviewer: But then do you have an example, for instance, of a problem that's kind of not in... within your own field, not within physicists... um not within physics and that you then encountered and then sought help to solve. And so I was just wondering like how do you encounter those problems because you probably don't know before you made the problem that you needed funding or. Okay. Maybe you knew that one,

Respondent: But I encounter them when I encounter them. Right?

Interviewer: Yeah. So how do you encounter them?

Respondent: I just hit a wall and then you have to solve it. Of course you can try to predict when you were encounter a problem, and we do that, like for instance, if you just have to know what you don't know, that's a good thing. It's maybe that answers your question. Let's say, that you don't know how to do a performance if you don't know how to perform magnetic resonance image data analysis. We were just told we have to do this FMRI pilot test. But okay, let's see. We go through this. We get some stuff because images, data, what can you say anything? I'm not an expert. So, uh, what, what we have done is we reached out to some who knows. So I have... I have.. I'm actually meeting him this week, Wednesday with a guy from DTU computer science who have already experienced with this. So, uh, this is always what I mean, just reaching out. Like it's, it's good to know what you don't know before I put up because we haven't done this stuff yet, but it's good to reach out a little bit. Then I don't hit a wall like in one month. Now after we acquire the data, we have to do analysis... properly we have to, if you want to compute something in this medtech area.

Interviewer: And why would you want to do it now instead of in a month when you encounter the problem?

Respondent: It depends what you want to do. Right. But it's easy to write a mail and scheduled a meeting. So that's, that's why it's always a good thing to do before because it can take time to schedule a meeting. So that's why. Yeah.

Interviewer: I see. Okay. So before, you talked about that one of your most important activities right now was the study with KU. Yeah. And okay. And I guess I kind of knew the answer to this, but is that something you think will change over time?

Respondent: Yes, of course it will. It will change, it will change to something else. Um, so we're done with the study and we hopefully have some results. It's probably not going to compute anything but it will probably give us a direction to head and the, it will probably give a direction where people perform a new study. Comprehensive study is actually like, it's like this is like a pilot test so we'd be only. We tried to see how does it work, the context of this study and they'd be taking experience with this study and put into a much bigger study. So you probably do a lot of mistakes in the first study. [inaudible] you don't do all this, do all this study in the very important test which costs a lot more money. So that's what this test.. the reason for this test. So is there to say you do all your small mistakes and learning for the first pilot study.

Interviewer: So in how would you know? So it seems like you're building up becoming better and better making less and less mistakes then how, when do you know when you have been successful in solving a task?

Respondent: The question again, it was successful.

Interviewer: Not the start-up. In a smaller scale, maybe you encountered some kind of problem and you want it to solve it. And then how do you know... I'm wondering how do you know if it's something you haven't worked with before then how do you know when you're successful in that task?

Respondent: Yeah, that's a good question.

Interviewer: You Cross your fingers and then you manage to, uh, to perform the task as you expected. You have some prediction, of course you have, you isn't what you want to see. And then, if we, if we don't see this then it's maybe not as good success. But basically failure doesn't exist in my vocabulary. So you always want to... you learn a lot. Yeah, of course. You don't always lucky that the results are as you predicted.

Respondent: And how do you then approach... you're doing so much, so many tasks that are new to you and it's the first time you're doing them. So how do you approach these tasks? Like making a business plan or...?

Respondent: Yeah. And you get straight into the task. Heck yeah, let's do it.

Interviewer: Yeah. And then you just correct during the while you're doing it... Or...?

Respondent: Hmm..?

Interviewer: So I would imagine that some of the Times did you hit straight into a task? It doesn't go well the first time. Maybe

Respondent: That is true, then you learn and the next time it goes better.

Interviewer: And then when do you know that you're done. Like now it's now it's good enough for..

Respondent: Never. It never... you're never done... no, there's always a new task at the priority list. Then sometimes things build up, and then you just do this. But there's always stuff for the list.

Interviewer: And then how do you.. how do you make the priority list?

Respondent: Yes, that's about every process. I don't know. That said it's, it's... it's by consulting with other people or. Sometimes. We sit together and talk. Okay. What is the most important right now. We did this today actually. We had a workshop in kukuie. Okay. Talking about a lot of things like how, which.. how we should approach and what is the long term strategy and all this stuff.

Interviewer: Yeah. And what did you find?

Respondent: Eh? We, we started brainstorming. It's hard to. It's hard to find anything I would say. Yeah, I guess it's, it's, it's, it's very hard to predict more than two months. Yeah. Well we were basically discussed interesting collaborations in the future. I think that that's what we found. I found the most of them. Yeah.

Interviewer: And is that a priority, a big priority at the moment?

Respondent: No. No, not at all. Not at all! We are quite... That will come later.

Interviewer: Okay. But you know that it will come later...?

Respondent: Okay. Yeah. You talk with people then it's all about people. That's the secret.

Interviewer: So um I now want to know a little bit more about you? You already mentioned that you're good at reaching out to people, but how would you, are there other traits and abilities that you want to describe that you using at this start-up? It can also be your education for instance.

Respondent: So, so, so just skills or something that I am good at?

Interviewer: Yeah.

Respondent: It's always hard to like talk about myself...

Interviewer: No, I know, but also maybe what is your role role in the, in the start-up. For instance today at the brainstorming session?

Respondent: Yeah. Um, so I have a quite a large role with the project. Yeah, mainly because I'm always... I'm there everyday and it's my full job that had been there the most. I'm the one who was spending the most time on this project the most of the time. Um, so uh, giving an owl say perspective on things is good. I'm, I'm, I'm a, I'm good at finding people and everyone has an a team, at least here with me. It's just people that I've talked with, a friend of mine, um, and I love to work together with together with people and learn new things. I think you achieve more when you're, when we don't have people. Yeah. So you have to find people are smarter than you in the, in the specific areas that is needed on your project. I think I'm quite good at that. So, so, so I tried to find people who were, who competes me in, in that skills. So if you're the smartest person in the room, they were the wrong room. So that's, you have to like add competence. Yeah, I think, I think I'm good at that.

Interviewer: And how do you think that the contribute to the startup

Respondent: contributors? A lot. Um, we have, we managed to, uh, to build the prototypes we have about minutes to get a lot of attraction. Traction. We got traction, we've got money,

we've got our own lab, we got the, we got to a bio stuff and a lot of people. I love this. No, not many people at that large. Yeah. What's your gift to you

Interviewer: and um, is that something that have changed over time?

Respondent: It feels it. What, what, what has changed, do you think?

Interviewer: So I was wondering if maybe you can, a, you feel like you have learned maybe some new skills, so all you had this data that you utilize. So I mean you said you had the overview and it seems like it's, it's more of a, almost practical practical thing that you have it because she went in your, they're always, so maybe you have a developed your planning skittles. So I mean,

Respondent: yeah, yeah, definitely. And timelines. I've developed much better timeline idea. That's quite important. Um, what else? Um, hopefully communication skills. It being a stubborn, stubborn on a personal level, hopefully becoming a better listener. That's also a personal trainer. I'm working on it and that's been a tough. It's tough to, to, uh, to listen and work where we focused on trying to, to do both. I know that that's a hard thing and working with, but you know, it's, it's hard to really focus and really work hard and then the same side be ready to respond and be very engaged in what people saying. A really trying to work out of that when you're helping other people. That's very important I think. Yeah.

Interviewer: And what about, how would you describe your education, expertise

Respondent: and experience? Well, medication expertise, you know, firstly you basically learn to comprehend very abstract for what's yours. And you also learned to read very difficult text math and, and you, but you also learn, most importantly not to quit. Like you. It's very, that's what I'm worried about. Hitting a wall. You're just one at target when you're just performed by your done. When? When, when, when, when the, when the task is Doug. Yeah, I do a lot of people. This is 99 percent of it. I would not see a lot of people. They, they, they, they at some moment in time they feel like this is too overwhelming. Okay. So then you use it? Yeah, I think. I think it. I think it's good just to, just to continue. Yeah. What about some of the other things you mentioned that you have learned, like reading difficult texts to use that in your work?

Respondent: The startup? Yes, a lot of. I have. So we talked about this perspective or, or the project. Yeah. So I'm, I'm, I'm, I'm a lot of places which also means I cannot have full control or what exactly everything, what did I have good people to be expert and the things. But for instance I have, even though I'm, I'm, I'm in the development of technology, I have to do a lot about the neuroscience. Yeah. So I've read, I read the 20 plus papers under neuroscience part and have to learn a lot there. That's also like a test or just hit a wall and you don't understand every third word texts written by scientists and if you don't know any, uh, terminology about the brain and the metrics and all this stuff, it's a hard one. You have to Google A. Yeah, yeah, I would imagine so. Uh, just understanding all of this.

Respondent: So I have a really good new ordinary science neuroscience part. Yeah. I'm not the one with expert expertise yet, but I can read. I learned to read the neuro science papers. Yeah. And so before you mentioned that a lot of the data sources that you use a expert people in Google and now you also mentioned the, what I imagine is academic papers. Yeah. So think about how do you get information? Yeah. So academic papers helps a lot as well. Yeah. Yeah. Web Pages. So let's say you're buying equipment, a webpage, it was webpages and then the and that. This divergence

Interviewer: also have the rotation. So you also use the issues. They get a Sheetz tronics data sheets of optical components there. She's light emitting diodes, all these things. Then how do you choose between these different data sources? Like if you talk to an expert in neuroscience. Oh. Oh, what I'm. I'm good, thanks. How are you? Oh, nice. Yeah, yeah, yeah. They were Danish class. She'll be like, I should've been there like 20 minutes ago. Yeah. What else needs a lit class? Yeah, it's a, I don't know, to 5:30. Sorry. Yeah. Is it, is it only five now? It's so dark. It's 5:50 now or this is it. Map. I thought it was in your kitchen, right? What do you see though? That was the microwave in the corner. You want to see how A. Yeah. Okay. You see him? He said your own personal lab. Yes. We got out with. We have our disk basically. We to go up there. What? It's using your left. So we just took the whole. That was quite nice. See over here. This is like a. This is the light source for. It's the science, the science part. I see some the some fibers. I'm so new electronics development here.

Interviewer: Quite nice. It seems big. Is it? Yeah, it's, it's a, it's takes a little sport. It's only one, so it's been okay. Yeah. So it's a little wider but fitter. I see. Yeah. This is nice, but it's still really small. The land, right. It was really. I felt like it was really small and the last time I saw it, yes. That was the electronics are a seminary, a TV screen to uproot our lives. See? It's quite bad. Yeah. And we have a lot of other stuff, so we have candy. I Love Candy. Candy's. Okay. It sounds like you guys are having fun. That was good.

Interviewer: Well have fun at the Danish class. I've used them on and. Okay. I'm almost done. Alright. Yes, yes. It's a case meaning. So what I wanted to ask was like how do you choose between what kind of data source you're going to use? Like I'm going to ask an expert. Google it. Find an academic paper. Yeah. And that depends on the uh, on the importance of their decision. Yeah. So say who you. Oh yes. I, I've consulted a lot so I always have people at my dad's company who's an eight person in all this electronics and so it. And you just ask people. Okay. And then, so that's also how you figured out how important it is. Is that, how do you figure out how important it is? I, I kinda. Yeah, that's great. Sometimes it's, it really it's feeding, right? Yeah. You have to like the side, you could not ask for everything and you wouldn't be asking your own day and you kind of have to kind of have to, you know, you have some general ideas and if you had no then you don't have to ask. Yeah. What, how, that's actually, that is of course my own choice. We have to say this is important enough.

Interviewer: Yeah. That's how most people, most people make the mistake. They, if they, if they failed to as skills. So judgment is too big, too good either. So that's not a mistake that you make. Yeah. Yeah. And so sometimes you make mistakes. Yeah. So it, can you elaborate on that, that some. So a big mistake is that you think you're too skilled. Oh, just to make, I just want to make sure I understand you. Normally I don't get to that

little finger autoscaled but then then, then I, because it's such A. Yeah. Domain tronics. Yeah. It does not mean you can take the decision alone that I've taken to get up with established history. Yeah. But if it's my own area and then take a decision. So we. So it wasn't make mistakes in your own area? Yeah. Yeah. And how, how is it when you, uh, three people making a decision?

Interviewer: Is that usually you are in alignment or. No? No, no, no. I don't know. Style and ivy can discuss our Atlanta. I'd be always bits, of course someone has to. Someone has to decide, right? Yeah. But normally we are. We would like, you know, it can be very. It could be things you could document and that's big. You cannot document it, but that's part of it. That's probably right. Yeah. So the ethnic, that's not big arguments and then there's things like the best things you can talk yourself out of and then the Sphinx, you cannot tell anything about because no one has done it.

Interviewer: That makes sense. Yeah, it does. It does. Something. So you could find, you could find arguments at Google, like people did this and this was. That's why it's a good reason to do it. Yeah. Build this electronics of the future and this way because these people fought as winter, but then there's times where you cannot do it because no one has done it or you can't find any good arguments on why it didn't become science. Right. Then it becomes niches. Then it's like, isn't this medicine bottle feeding? Is that something you encounter a lot this? Yeah. Actually sometimes. Yeah, it's that it, but then we just images. Then we just make sure that sometimes we'd go my way and sometimes you go style away like that. Only like my way through there. Okay. Last time I did new, a new way this time within my weight because that's just how you are with you when you make technology, you're just in hardware, I and you just, sometimes you just want to do it to a different ways, but then you just have to go one way. Yup. Yup. Well that makes sense. It's basically when you're a startup, I imagine you make a lot of things that haven't been done before, although I said wouldn't be as bad of. Yeah. Yeah. Especially I do kind of by what you're making. Yeah. Which is really good and a bad thing.

Interviewer: So the startup is a light source to treating Alzheimer's. Yes. Or at least the stopping. Slowing the progress of silence. Absolutely. Yeah. The person of the. The cheese. Yeah. And, and what you're working on right now is proof of concept at, at the light therapy works in, in stopping the progression of Alzheimer's. It's that it's exactly what we doing. I mean we have proof of concept technology. Yeah. The patent idea and how you make a technology. Yeah. We have shown that now it's just all the neuroscience part. Okay, great. I, we have to show him that the functionality to go. So the proof of concept that they, that the light therapy works to stop the progressing at Bell Times. So that is in the realm of neuroscience. You could, you could say that it's because the way this is patented so dependent goes how you make the technology.

Interviewer: Yeah. So now we have show. So that's technology proof of concept and as a medical medical proof of concept. Yeah. So the is how you're making technology and we have shown that you can make it this way. Yeah. And then then that's the much harder part. It is showing you to use this technology to help people. Okay. And then how, what, how are you planning to show that? Yeah, that's fair. That's bad. As long term goes, this takes 10, you notice 10 to 15 years. Okay. Yeah. That is the time range for an average, a pharmaceutical or anything that has to go out.

Interviewer: Devices can be between. It's all five to eight years of helping. So much much. No. Um, some, even though it's a one year. Okay. Yeah. But the study that you're having right now, what is that proving? There's a pilot study, so it's not proving anything yet. Okay. We'll need to get expertise and show that something is happening. So what about this study after that? That the study off the hose is made of plants is they need money to plan everything, right? Because reading is money. That's time, right? So it, we be looking for like a two year study afterwards that will show that it will slow down or stop the progression of outside of this. Okay. But this study in the beginning of this to show that that's happening, some activity in specific areas of the brain that are interested. So that's people compost and tatum was and also Mitchell cortex and the see how does this effect here? Is that something that's for right. And then what is happening much later, I see in, so right in the. Yeah. Now it's a long time ago. But you mentioned, you mentioned that you wanted to like ideally you want it to cure Alzheimer's.

Interviewer: Yeah. Which is a really noble goal. And do you have proven that the technology works and now you're, I'm working on proving that the light therapy has an effect on the brain. Yeah, it's A. Yeah. You. Do you think there's any other aspects that is important to be considered? That probably is. It's probably a lot of aspect. Yeah. Yeah. Most likely. What is the. Oh yeah. What do you want? No straight road. No. Yeah. Well what did you say? Yeah, so I was just like, game. If I mentioned something about like the patient side of it, how they experienced it. Is that something you have considered? We have, we have considered so they could have thought. Yeah. How would you describe the type of activities? Did you have a engaged in to explore the patient side of it? And we. So we, we have had calls in entrepreneurship.

Interviewer: Yup. Do that. We have two different groups. Okay, Yep. What two groups are like 10 people also myself a cure than in one of the team and mentoring both teams. Okay. Yeah. During this you can say study or automated. We have a contact with a lot of different customers. Okay. As time and also organizations like as sweet as a different or in organizations see what those people do all what also also visited different homes and the. You mean even one of the homes? Have we have shown one of the lamps? Yeah. Didn't they didn't like the House that we had. We had no, we had no fault of our group that we just made electronics and hardware. We haven't even thought about. We just put a few on something. We don't take that as a tribe. Is that a try? But, but why did we could not be converting at least is that they care about hugs, do it. Everyone does that. I could have been avoided, but it's what it looked like. Testimonial.

Interviewer: I did. Yeah. I mean it was also a three d printed and so on. So there's a lot of. So when you do a proper trial or even thought about how to gauge when it then we will have more, but probably will make a what is, what is it called it the Schema to ask people how they, how they like it. Yeah. We'll get you maybe 10. You can even have it if you're lucky. Yeah, no, of course with the device. Yeah. Really when I got two years I have a couple of devices with me for you. Okay. They don't be nice. Of course. If there's anything I could do. All right. So going back is. So how would you describe your decision to engage in those activities? I'm almost done. I promise my decisions to engage. Yeah. So why did you choose to talk to those organizations and homes and so on.

Interviewer: What do you. I think it's important to know your customer. Yeah. But that. Are they your customer? Yeah. Maybe not, but they are there at least eight years. Yeah. A patient if you can say that. Yeah. And why do you think it's important to talk to them? Because they will be the one using it. Yeah. Since we have. It's a hardware solution, so it's, it's something physical that that's very important because they will be put into some context so and the context has to be right for them to use it correctly. So that's extremely important. You could have the most beautiful, you know, all of this about just me. You're going to have the most beautiful product with the best software. Everything. Very expensive. Both sell it very cheaply and you're a good guy but they don't use it correctly. Then the, and it doesn't matter at all.

Interviewer: That'd be manage that and. Okay. My last question and then I'm done. Then we can just talking social talk afterwards was so a, it seems like you've really thought about this aspect in and how would you describe the type of data that you have relied on? So you mentioned you talked to people, so it'd be like consulting and reading. Yeah, I would, I was the grade. What was the question? How would I describe the type of data? So I know that you have talked to, it seems like experts in some of the organizations. Yeah. And maybe also patients after whom. What about like some of the other data sources you mentioned were academic articles or like were pages and so on. Is that something or maybe something completely different, but when you meet type, what do you mean by type? So is it the. Yeah.

Interviewer: So for instance, is it when people tell you, or maybe from an article you get statistics. I don't know what type of statistic that would be, but it, it, it's, it's, it's, it's quotes, it's all one to one. Yeah. And is it mainly, would you describe the people, people you have talked to? Mainly as experts, like the people in the organizations or a future end users, as you mentioned? Yeah, it's both. Both, yeah. You try to talk with as many people as you can. Yeah. Makes you want to talk with an expert in everything. Every single detail. Yeah.

Interviewer: So you're like, okay, let's say for instance, we also do a lot of regulatory work. Yeah. We're consulting with a cinema Papa's what experts in Medtech regulatory, but even though they are experts in the regulatory world, you could. You could be even more specific. So even though we have been talking with them, then we need something specific. Well, I want to take a lot, so we have to find another guy who's an expert at this. Yeah. So that's it. It's, it's not as easy as a. no, there's not one single insight. I guess that's not, that's not a single answer. Yeah. So you're gonna mistake. Yeah. Okay. I think I'm done and I've gotten four minutes over time. Okay. No problem. But yeah, now we can switch to date is marvelous.

CASE 3

- Interviewer: All right, but now I know you've talked a little bit about it before Diego, but tell me about the start-up you're working with.
- Respondent: I started out working. I'm working with startup to shorten the rehab process for burn survivors that they have to go through. You want me to explain to you?
- Interviewer: Maybe just high level. So I know it has something to do with some fabric. ..?
- Respondent: Yeah, yeah. Like when you have been burn, you have to go through a recovery process to avoid hypertrophic scarring and keloids that are... like keloids is when you start like they.. um...increasing their volume. It can get very, very bad. For example... get like the size of bubble, and you would have to cut. It had hypertrophic scarring is when it become really, really hard. So for example, if you have a hypertrophic scarring your hand in, um, that part of your hand it becomes really hard and you will lose mobility. You can have any... burn in other parts of your body. So it's not just a aesthetics as many people think it also have functionality. So to prevent this you have to apply pressure 24 hours a day or 23 you can with garments like with tight garments and this last two years. So it's really, really... so the reality is that it is really complicated. Like basically, like and also like having it on yourself like every day for two years. So we want to improve this. We find out that there is a like effective range of pressure that if you don't apply that, your scarring become hypertrophic and it also will increase the length of the therapy. And the patient doesn't know like what pressure the garments are applying. So we, they, uh, um, uh, pressure sensing device is placed within the garment, on the scarring, and then it can tell you what pressure that the garments are applying so you can change them if they're not applying enough pressure or too much that could cause serious damage to. But knowing that... like starting my research here [at Berkeley], like I found out like the reality for people. And I think that... that should be most of the worlds, not like in Chile. In Chile you can get this like rehabilitation for free thanks to the center that is there and take care of all the children. But if that's what most most motivate us, the biggest in most of the countries in the most... the biggest percentage of burn patients are children between ages zero and five years old.
- Respondent: For example, in Latin America this, this estimation... I just find out they suck. They're really bad in every country there and even here in United States and. But this estimation says that there's like a 70... between 70 and 80 percent of the burn patients are in children younger than, I think like, 8 years or something. So yeah, like that's where we want to help them, I came here.
- Respondent: I found out like the sad reality is that actually people here can't even afford the treatment. I didn't even had that in my spectrum, because in Chile it's free. So it felt like OK, they are garments that I knew how much they cost. I knew that was like maybe, maybe it was high price, but OK insurance pay for it. So I hear the health system is not really good. You can pay for, for good healthcare if you have a good job.

- Respondent: And most of the people don't get better. They don't have a good doctor. They're normally, the demographics of them are like normally people normally with not all of the education, sometimes their father, so they don't take care of their children so they get burned.
- Respondent: And also like I have, I don't know, I have always like hated regulations. Um, this was like one more reason like in Chile the garments s don't have to pass through a lot off certifications. Here, you have to, they have to certify that the pressure that you told is correct. That's makes the procedure more complicated. And increase the price of the garments, right? They're also have to be handmade because it's complicated. You have to cover a different kind of garment for each person. And that makes it even more, more in big expense. And another thing I found... is that some burn centers are also increased the price of the garments, the resale, they don't even make them. They just take the measurements. They just send to a company to make them and they charge more than a hundred percent more profit just for making that call to the, to the company. And like the reality is that... when I started asking like how many people can't afford this treatment? Like 20 percent, 50 percent, 60 percent, 75 percent. Pretty big issue.
- Interviewer: Mmhmm... And how... both the fabric and maybe also then the pricing. So how, how does your startup solve that?
- Respondent: OK, so my start up? Yes. As I told you before, we can tell you how much pressure you are applying so you can change the garment if it's not applying enough pressure. But now like the trouble is, even though we could now... like if they [the garment] are working or not we can't change it. So we have to figure it out now. And what I'm thinking now like why I can come with like... this like last three days... because this was like... just the last week was to create garments that can be tight. So you kinda like see you can make like you don't have to, they don't have to be handmade so you then you can decrease the price and also eh, in order to be a pressure garment you have certificate that certify the amount of pressure that you're applying in order for that. Then we could use our pressure sensing device.
- Respondent: Actually it's really took like this.. the sensors that we are looking for are like 10 dollars. So we maybe with all the certification and stuff. So like a pressure sensor is pretty small for a [inaudible] thing or something that the burn centers and then so the garments that don't have to pass through that, they will come to pass through FDA approval in order to be paid for insurance, but they don't have to do it. The sensor will check the pressure so they don't have to pass through all those tests and they will not have to be handmade if you can like eh, like modify them, like make sizes are for not only, that just will help to eh parts. The like in circle through circle. I don't know, for example in the hands you can do something on your face but you could do for your arms or your chest or your legs will be like something to start with, but in any way we have to go through a validation process with it.

Respondent: Actually we had to... I have to talk to my team... You just got my in the hard part of entrepreneurship. You are in this part where when you look back and you say, OK, what the hell do I do now? Eh, I know. I like... we came like really far with all this thing that were like we always go through this kind of stuff but like understanding that everything that we have worked with the children in it had to be. We'll have like different... I don't know, wouldn't work here like we're have to do something else to help.

Interviewer: So you would... if it goes your way with the team, you would make a new type of fabric..? That is better suited for making kind of a generic fabric suit..?

Respondent: Yeah, a fabric that you can like tie and untie. That is really cheap. You can like... you can like just tie it and you will know with this pressure sensor... pressure system really quick if they got how much, how much you have to tie the garment. That actually will help the... in many ways. For example, there are many problems in this therapy. When you ask for a garment, you have to wait until two weeks to have it. I take two weeks for you to cut it, so that makes it... That makes the, the procedure less effective. So the first part or the... most important part to make pressure like the first six months, the first month, and this is crucial for the rest of the therapy and like. And it goes like that. The first six months are more important than the following nine months. So the, the earlier you start applying the better, and you're losing like two weeks of that first. That's really important about this sensor technology. So, we start... I start thinking just making a pressure garment that work. I have to validate all.

Respondent: We'll just make it cheaper, so more people can afford it. Like people... like people right now are using Under Armour, actually instead of this garment. That is what the therapist tell them to use. So we wanna do... something that is priced similar to that, but actually compress well that is the important part.

Interviewer: So when you came up with the idea in Chile there wasn't this price problem? So initially in Chile what was the problem you solved there? If they had the money to fit the garment?

Respondent: Okay so the thing is applying pressure all over the treatment can decrease the length of it. And improve the results. Curently there is a 20% of people that this treatment doesn't work if they are in compliance with it. So you can increase also the successrate of the treatment by constantly applying the effective pressure, and they don't know when they... when the garment stop applying the effective pressure. In Chile they didn't care about changing garments. Here [US] they can't.

Respondent: So in Chile the vision was they they would have the pressure on all the time and then it will tell you when you needed to change the garment and then you change it. Now the vision for the US is that you can customize a generic garment?

Respondent: Customize a generic garment that doesn't need to pass through... like we have to pass through FDA approval...but it doesn't need to be... to pass through all the... I don't even, I lost it. So as I told you when... when they make the garments, they have to certify that the garment will put a certain amount of pressure on the body. Um, that procedure is made with tools that is expensive. And worse, that also takes time. And that makes the garments more expensive

Interviewer: They have to certify each individual garment?

Respondent: Yeah.

Interviewer: Okay.

Respondent: So if you, if you have like the pressure sensor, you will have a, you have a garment at that state, you will have to certify that because the pressure's. So we'll certify your, the, the garment will have to pass through all that procedure so you will save money on the garment. And the pressure sensor is really cheap so you can just buy one for like... or even give it to... like give it to, to the burn centers I think. And I think that that will solve the problem, so more people can have the, the therapy. Also another thing that just in this March, they came out with a paper that says that after like one month, the garments that are applying the 50 percent of the compression and the two month... two months after it is not applying pressure at all. And the people now are changing them every three or four months. OK. So if you can do something that adjust to each patient, you could adjust each month. So you keep applying the same pressure over time. That will be also a good thing to do.

Interviewer: And... and they.... why do they only change them...?

Respondent: every three or four months? Because the insurance pay that.

Interviewer: OK. So that's in the US?

Respondent: Yeah, they fix it or something like that before. But it, that's because like there is nothing. No. Like before that paper there, there was no one that really tried to measure the pressure in this sense. I think is a small field. So. So like I actually don't know. People don't, they're not much researching it. Like for example, I went to a conference this year, they came out with 40 papers and that was a lot, last year it was like seven or something that's in this, in the field, in the whole field for burn patients.

Interviewer: And I... So does it hurt? To have the garments on?

Respondent: Actually, it depends like Eh, you are uncomfortable because they are tight, like they have to be really tight. And if your are hot, for example, if you're in a hot fire because you're using a like takes us, you went to yes. Without, with a teacher. If you have burned your arm and your chest, you will have to use this

compression with garments and that's... that's like the most complicated part; the hot. But like it doesn't... like it doesn't hurt. At least if you do a sport with it, it could hurt you. For example, like the friction on your skin, but if you don't it won't.

Respondent: So do burn patients usually wear it the 23 or 24 hours a day?

Respondent: There's a huge compliance problem with it. As it is a highly exhausting therapy and invasive. And there is a... a huge compliance program, summer centers, the half of them use it as some of the 30 percent use it. So there are other people that stopped using it after three months.

Interviewer: OK, and do you think that your startup also addresses that?

Respondent: Well, actually, we always went to the address that like with the same focus, like [inaudible] make something kid friendly, kids has always been our focus is, but it's actually. I think that like I would love to do something that is not uncomfortable to use on, but for the nature of the therapy I see that probably will always be uncomfortable to apply pressure over yourself.

Interviewer: Maybe especially if you have a... I guess it's almost an open wound?

Respondent: Yeah but the scar is already closed. Like you wait two weeks to be closed and then you start applying the pressure.

Interviewer: I remember you mentioned that with your start up. You can maybe lower the time... decrease the time..?

Respondent: if you apply an effective pressure all the time. Like most. Well there are some therapists don't know, don't think about it. But some therapists think that you could really use a lot of the time and also increase the rate, the success rate of the therapy.

Respondent: Why do you think that people stop using it after three months?

Respondent: Because this is really uncomfortable to use it. Like you don't want to like use... I don't even like to taking pills. Like if someone told me that I have to wear the same garment everyday, uh, that will be really complicated for me. With children it is easier because the parents forced them to use it. People, they stop using them quite often they, they just don't comply with it. They can't.

Interviewer: So how has the compliance for children?

Respondent: It's better. It's way better because like parents make them use it. But anyway, there are some, some fathers there are not that hard on it, and that sucks because if you have burn scars as a child you will have to pass through a surgery to fix it. And when you have surgery once it is going to be more common to

have to do another one. So you can be doing a bunch of his surgeries as you start growing because your skin doesn't stretch as the same.

Interviewer: Yeah. So it can't really grow with the rest of your body..?

Respondent: Yeah. Yeah. But compliance is a huge problem actually. It will be great to also address that. But as I came to... with there is no way to make a start up that can help burnpatients if it doesn't lower the price of something. You can't actually like, like... some, some doctor told us that you, you kind of spend like 1,000,000 in saving a burn survivor because the surgeries are really complicated. So um, there is no money for the... Most of the people that are burnt doesn't have money. And normally the first focus is saving the patients on. They already spend so much money saving the patient that they don't want to spend more money in the rehab.

Interviewer: I see. So if they do have the money to get the fabric do you think that with your product compliance will change when it's tighter?

Respondent: Well, you know, there are some pros about it... that the pressure. If you get, if you get like used to it, the pressure decrease. The itch in the wounds it is a huge like problem for burn survivors. If you have a scar, you really tich. Yeah. So you want to. I don't know how to say that. So they started like open their own wounds, scratch it, so that will, that will help. For example, today it's probably a bigger complained that pressure. And also some of them them, feel safe with garments when they get used to it. Sometimes when they get used to it after like a time, they don't want to take them off. But it's just those three... like those three most you you can like covince burn patient to wear it. He probably would complaint the rest of the therapy in those first three months is if they stop using it, it, it's not just they will never recover it because they're like, even though it's like, I don't know, start using the garment again. All that.. all that time they're going to... The scars would start becoming hypertrophic really fast. Actually. Maybe make the way is to people... to get used to garments in the first three months.

Respondent: So it seems like there's two really big problems in treating burn victims and one of them is that the treatment isn't efficient enough. You are not, you cannot apply enough force or pressure. And the other is that it's not very high compliance. It was only 30 percent that were compliant..?

Respondent: Yeah. Well there, there was a study that said it was 50 percent depending on what state you are in because it is really hard if the compliance decrease. Just things like that. Yeah, addressing kind of the pressure. When we started it was the pressure, to optimize the pressure by. OK. That was like the problem in Chile and I came here to realize that the first problem was expensiveand the second problem was compliance.

Respondent: Yeah. So um... What was your kind of intro to burn victims and like working with this start-up?

Respondent: I started working in my university in Chile with this burn center for... They wanted to objectify the treatment. So we did our research in objectfying a treatment of was that was what they want to.

Interviewer: But did they come to you and asked you to do it or did you seek them out?

Respondent: That was in a course. So there were different companies with different challenges and you have to make with your, your classmates, your classmates. And lapped to different challenges.

Interviewer: I see. So you applied for the... how come you applied for... that one? Or.. so why did you apply for that? Why did you choose... I mean I don't know what the other cases were but I'm sure they were pretty interesting too. So why this one in particular?

Respondent: Well actually the other ones weren't really Interesting... Like the, the... I don't know. They make it look like it was interesting about working with people that suffer from... I don't know how I was like OK, like I don't care if I can make like a company make more money. Like I would prefer someone that's, that feels really bad, I will make them feel better. So we were like really motivated in the course for the same reason because we knew that we were helping people that are suffering.

Interviewer: Is that also why you continued working on it?

Respondent: Yeah, when... actually... like burn... burn victimes are a really small market.

Interviewer: Well luckily... well thank God that it isn't bigger.

Respondent: Well I don't know if it will be bigger. Probably more people will be encouraged to solve the problems locally. But I don't know, like, it is not really luckily.. actually like the most, there's countries that are not specialized in for burns you need a specialist center because there are like really specific kind of want those very complicated and there are many countries that can afford that so they don't have that. So I continue this because say like, learning so much about, uh, about it, I was really motivated. I always felt like in all the people that are suffering, like I went to the burn center, I was cool, like seeing children there and they were like, does burn center is special because you go see like all these people suffering like they don't have, like secure, safe place where they could like be happy. Like looking at people and people that suffered enough. Like a smile. Thank you. It is really worth it.

Interviewer: Yeah, I would imagine so. So what would you say is the, like the success of what you do? I mean the start-up, what would be the success criteria for you?

Respondent: The success criteria will actually, you know, if I could, if I could say that I, for our start up, there was a 30 percent of people that couldn't afford the treatment and now can, I think that that will be a success. If I will say that if we can make it better... to make it like affordable because it was like OK, we want to... us engineers.. we want to always... but now you see like the big, like now that I see the big, the big problem, there's people that can't even like get the garments. We were like OK, like the people in our burn center are really lucky to have like the burn center that they want to optimize the treatment. But most of the people can't even have the treatment, so probably that will be a problem that we will like more to attach the.. than just to make the treatment better for the few.

Interviewer: Yeah. So you want to make the treatment more available?

Respondent: Yeah, I do.

Interviewer: And so there's these two problems, the compliance and the.. yeah, of course, of course; the price. Do you think the price is the most, like if you solve that..?

Respondent: The compliance problem will still be there., you solve the price the compliance will still be there.

Respondent: But you feel you will still get a long way with... the longest way with the price maybe or how do you view... like so you want to help burn victims. Do you think that the most efficient way of doing that is attacking the price?... In the US at least. Or, how did you choose that?

Respondent: Will you know? It's not just... I don't just think about the price. So think about a hybrid or something. As I told you there are many countries that don't have burn centers on the most part. In rural rural areas, so maybe like with the same concept we can help people that can't go to the burn center to treat themselves, to be treated in their villagess or something like that. But for you say, the thing that the way of making it more available... more available is to decrease the price. That was... um compliance... Actually I would love to attack compliance, but they're already... already well... for example, if we make a garment like for sure we would have like cool design for kids and stuff like that, like spiderman or the princess, like that's like a thing for sure we will do, but I don't know how to make like everyone went to use the garments. Because with design you can attach like emotional people you of touch the children or teenage years. But the old people for example, they're not going to care about these things.

Interviewer: So it seems like you attacked this problem a little bit about the compl... I mean it seems like you've drilled a little bit into this compliance issue. Like with the pattern on the fabric and so on. So how did you... What was kind of your approach to that?

- Respondent: Our approach to compliance?
- Interviewer: Or just like dwelling into it. I know it's not something you worked extensively on, but it seems like you have had at least had some thoughts about it.
- Respondent: Yeah, for sure. Like first we were doing like a pressure sensing mask, because the face is like the most complicated parts of the body. Like when you got burned your face. People, everyone looks.. stare at you. If you have seen like people that have their face burned, it is not just like external things. Like can you loosen your muscles so you, your, your, your face change all around. You can lose your nose, you can lose the capability of smiling. So people can't help but staring, at burn, burn, burn survivors that have probably the face. So we, we went, we really wanted to attack that problem problem because if you know that you are not... your face not aesthetic. And everywhere you go you have people's staring weird at you... like that will probably eat your mind. Like you will probably feel really bad about it. It's not the face mask.
- Respondent: OK. So the thing is when you have the mask for them, it is a hard mask, it's thermoplastic. So you put in your face, and it takes in the shape of your face and then you tie them in the back like a hockey mask. And is also.. the material also apply pressure on the side of the face without the scaring, and that would be bad. So we make like a pressure sensor mask that was maybe with like a fabric that was really cool, you can chance like the the mask, you can be a tiger. It's always like we wanted to make something like really human. To make burn survivors feel like cool or cute, and when people saw them they would be like oh that is a really cool design instead of oh that is a really bad scar.
- Interviewer: So you really have thought about this...?
- Respondent: When we, when we, we came up with this idea [pressure sensor] we completely lost that part. BEcause the pressure sensor is something that goes under the garment. So you can't do much about.
- Interviewer: Mhmm. And what is it, that your background is again?
- Respondent: I have a major in Design & Innovation, and a major in computer science. I also have to... after this I will have a major in industrial engineering.
- Respondent: A lot of majors, yeah I know.
- Interviewer: And what about the rest of the team? So the Design & Innovation that's also part of engineering school, right?
- Respondent: Yeah.
- Respondent: All of us are the same. Design & innovaiton, there is one electrical engineering, a mechanical engineering.

- Interviewer: So you're used to talking to users and engaging in a design process.
- Respondent: Yeah all that.
- Interviewer: So it was a... coming up with these like the Tigers and the patterns and so on. How was your approach to that?
- Respondent: How has our approach to that? And I'm like well what's really... we're working with children and we knew that we had some how to make them want to use something. And I have like a five years old brother and when I show... like showed him the cap with the... mask that was like a tiger. He didn't want to take it off. So it was like a really... we understand that yeah, this things works.
- Interviewer: Nice. And how many... how, how is the organization around it? Sorry, I'll just draw. It's you in the startup is, it's like kind of is still kind of in the university in Chile? Or is it... is it your own company now?
- Respondent: Now it is our own company.
- Interviewer: And so I guess you're one of the founders..?
- Respondent: Yes, there were three founders. And the reason we wanted to come here... You may if you want to talk to her, Andrés and Humana...
- Interviewer: And you're all co... co-founders, and do you have specific roles now?
- Respondent: Well before when we were doing the the pressure sensing device, I was the CEO, Andrés the CTO, and humana was the CR&D..
- Interviewer: C...R&D?
- Respondent: Research and development. She worked... she took care about the research and development.
- Interviewer: I see. And how is that different from the CTO?
- Respondent: The CTO takes care of... Well actually Andrés was more on,.. she was like CTO and CMO, like she...
- Interviewer: And CMO...?
- Respondent: Is marketing. Ok, but in the CTO... Andrés take care of about the technology part but just like the part of the sensor working, and humana was more about the sign off it like.
- Interviewer: I see. But you also have a background in Computer Science...? What about, do they also have an extra..?

Respondent: Andrés, yeah. Electrical engineering and industrial engineering, in Chile you take like six years for going out of school.

Respondent: Humana in mechanical engineering and industrial engineering. But she haven't started industrial engineering yet, but she has to. The same as me.

Interviewer: So she also has computer science, the same as you?

Respondent: No, industrial engineer. But she hasn't... I don't know how, how [inaudible] taking three courses that I have to take. I'm done with design and innovation and I'm like, like near to end up computer science and industrial engineering. Yeah, the titles they're really weird. Here you stay for years and you go out with the same title. Ok. Like all this, like we just, I were like this like for a month... and the programs were different here [US] is probably going to be way different the rest of the world [inaudible].

Respondent: We have to start doing the research here [US]. And then we helped, we started doing research as a team. Like, so as you go, you talk to people, you're like, I don't know, drug conclusions and now we have to see what we're going to with the information we got from the conference.

Respondent: Okay, so how do you do that? So it seems like you've got a lot out of the conference. So what is your approach to doing that, doing that research and taking decisions? Three people?

Respondent: Ok. So normally we're doing interviews like, like to ask people about what are their problem, what are their biggest problems, we try to make them quantify those problems. Tell us how big the there were and that's how we found out that... we can't like tell people that garments aren't working they can't do... think about it.

Interviewer: And how do you find like the right people to ask? If you have a lot of uncertainties and you need to find someone?

Respondent: Yeah. Well actually we knew that we wanted therapists, because they are the ones that work with this treatment. So we, eh, there was a hole and everyone had like up here so you could see there were therapists and just like ask them in the hole. They were drinking wine and having like snacks. So most of the time they talk to you for five minutes. I saw them... I knew some from before for other interviews that I've done. So I asked them for mainly meet and do interviews a little bit longer. Like people in the health... in the burn area.. people that work there are really nice people. They are not following money so.... so they're... they're always started like speaking to each other. So they say, hey, hi. Where are you from? Some tiems they were therapists, so we also interview them. It's like just being there... like with like all the people have the burn work.

Interviewer: Yeah, I see. So it seems like it's a whole community of... sending it around. And you have talked a lot to therapists is seems?

Respondent: Yeah.

Interviewer: What about, I would imagine there's also other stakeholders...?

Respondent: Yeah, yeah. Well... be the doctors, for example. The doctors... in all.... the doctors don't care that much about the therapy. They just care about saving the patients. And they already spend so much money saving the patient. That they're like; ok, I already saved you life, I don't care about rehabilitation. They just like tell them to go to a therapist. There are other stakeholder that is important. There is the the manager...um director of the burn centers. They are the ones that have to keep the center going. And for them like the pressure garment... the therapy is one expense more. And another thing that bring costs and doesn't bring money back. So that was another important stakeholder. And the other important stakeholders are survivors and their families but it's kind of complicated. Talk to them like they're, you probably will have to be like introduced by someone and none... and there are not like enough thrust to introduce us to burn patients here [US].

Respondent: So when I talked to one... um... and um... and like....

Interviewer: A survivor?

Respondent: Yeah, a survivor that was working in a foundation and like they, they can't like, they think that they're so much more emotional here than physical here. They don't even like they, They don't care about the treatment, they don't care about how they're going to tomorrow. They're like constantly fighting with himself for like for house, for all the pain that goes through and just come to realize that their, their physical body is never going to see.... That emotional pain... like its way beyond like, eh, all the pain they can go through. So actually if you start like asking him like are you ok? Like what's the use of prescribing a therapy. The probably will end up breaking, breaking... crying or something. Just talking about their own problems because I don't know, they will start like talking maybe about particular therapy and then it's like I even feel bad asking them about the problems of the therapy when they have like way bigger problems to worry about.

Respondent: That's the solution that we came with this talking to fathers.

Interviewer: So talking to the family?

Respondent: So to still talking to them about burn surviving.

Interviewer: So how does that... what do you think about that data?

Respondent: Actually I haven't got data. But we just like realized like with all the... all this was like a big breakthrough. Ok. We were like ok, we did like a really good research in Chile, but it is really small. So like then we were like, so we have to now interview fathers. Yeah, we, we want to like interview fathers, but in Chile not here.

Interviewer: And it's different here than in Chile?

Respondent: Um.. well.. probably it will.. Well actually went to interview one father, and he told us he was like really like taking care of his daughter like 24/7. Normally fathers feel like really guilty for their children getting burned and they are overprotect them after... afterwards. I don't know.. I have to... I should to talking with more with more fathers. I will have to.

Interviewer: So how... so that's uh, something you will do in the future. And how do you determine that that is important; to talk to them and not someone else like their school teachers, or..? or talk to experts or like how do you determine which person? Because you only have a limited amount of time. So how do you kind of prioritize people?

Respondent: Well actually wherever I go, I prefer the therapists because they are the ones that have more... I don't know... the biggest knowledge about the therapy. And also they have seen like a lot of patients. So with one therapist, they will like.. they can tell you like the different reality of a lot of people like their point of view it's not as subjective as talking to the same patient. But... like... it is more efficient in this way.

Respondent: But yeah, you have to cover like, I don't know... Yeah. But so...

Interviewer: So why do you then talk to fathers, or why do you want to talk to fathers in the future?

Respondent: Because most of it for the compliance program, probably and the expense problem. They can... They don't really understand. If they can't pay, they're the ones that no way they can pay it because here, like they probably go through the different ways they, they, they like probably in the... they're like the other side of the problem. They see... the therapist just see the patient when he goes to the checkups, and the fathers see the patient every day, every day. So maybe there's something else that we haven't figured out. It's a bigger problem than it. Maybe there is a reason for the non-compliance program that we haven't thought about it. Andservice the.. to be honest with it maybe, but I don't know like I have to like I come here [US] thinking that I knew the problem we've got in all the world, and I understood that idea. So I had to research I did in Chile I did again here. I'm like every time I feel like there are many things that can make a difference. So.

Interviewer: And that is your overall goal; making a difference, as you said earlier?

Respondent: Yeah, actually I, I liked, I like to do something with social impact, actually. If it doesn't have social impact I don't know, it wouldn't make that much sense to me. Like it would be, could be something fun to do but I wouldn't be something that I will take maybe be thinking about all the weekend when I go out to party. Like it's probably only when they come to next... like don't... like normally when I work or I don't, I, I'm like... hard to get interested in things. But when I do get interested, I get obsessed with it. I can like it, I get more interested with. But I don't know,

Interviewer: So speaking kind of of that. We talked about your education and background, but how would you describe like your own... your personality traits or personal traits and abilities. How would you describe those traits?

Respondent: My personal traits?

Interviewer: For instance you seem very engaged in this project...

Respondent: Well actually, for example, last semester in Chile I think that I decided to give the same importance to college than this project on that.. and that make all my grades go down. I passed all my Um, that's like, like studying in Chile or having a start up, that is nearly impossible. But that was one trade.. trade-off I think. And stop seeing my friends, I remember that I went out for like two times in the whole semester. Like last semester. And were trade-offs. And probably a lot of mental health.

Interviewer: Yeah. So you're very engaged for instance in. So how do you think that kind of brings the startup forward? How do you think that play with the... Do you think that the start-up would be different if it was other people working with it. That for instance weren't as engaged as you. How do you think kind of your personal traits effects the startup? Does that make sense? So I mean it's clear that your background and your education has a big influence on the startup. So I'm wondering...?

Respondent: If it has? Yeah! The engineering part at least, but the design and innovation has a huge impact in what we do, like all the persons we went through to come up with like what the solutions is. And I think that... eh.. so your question is like how can... can you make it again?

Respondent: So in, so yeah, I'm thinking like all of us, even if we had the same background. We have different personality traits. For instance, you are not very engaged in all projects, but you are in this one. So I'm wondering if, if you think that has an impact on the startup?

Respondent: Yeah, I think so. I think so. A lot actually, normally when we're going through bad times... if you don't show, like your engagement and it makes... it's, it's hard like for the team, like you see the other ones that are not that engaged. For example. You did you get this, this motivated just. Yeah. If you could say I'm

motivated. I don't know what speed you go much to go through the startup phase.

Respondent: So do you think that you kind of helped you? Or helped the other people in the status staying motivated and that's a big...? Yeah. So it also seems like you come... all three of you from engineering schools, you met each other at design and innovation. So how would you describe, I mean especially because that's what you know; your own network, but also kind of the teams network?

Respondent: What do you mean? Like our network? Like what? Like people we know that can help us in our start-up?

Respondent: Yeah.

Respondent: Well, in our university in Chile there is a growing um, startup environment, so there are many funds and things that you can apply to and that help us a lot. Also the director of our... um directors of our major is really a good entrepreneur so.. she helped us a lot to uh, I think that, um... um...

Interviewer: But also just... it can also be like maybe what your friends are studying or like your family background and I mean you don't have to tell me everyone in the whole... you know, but it was more like I guess... you know, a lot of engineers and you maybe also now a lot of burn center therapists. How would you, how would you describe like the headlines of your network?

Respondent: Well, the university we know like most of the people that work for funds for start-ups. Eh, and my family. My father is a entrepreneur, I think that that's why I like since I was a child I already went to have my own start up. He goes keep talking about it. And what else? Yeah. Like, always being an engineer... makes, you want to solve problems. So like startup still way to solve the problem that you care about.

Interviewer: It's beautiful. Diego. It was really interesting talking to you. Thank you so much.

CASE 4.1

Interviewer: First of all I want to thank you for helping me with my thesis, I think we already talked a little bit about it, but there's no right or wrong answer. It's just your experience, I mean, you're definitely the expert on that.

Interviewer: Um, yeah. So first of all, I tried finding some um information. I looked online but I couldn't find so much.

Respondent: No, it's still very, very... was like we're a up as, as an entity right now as like a... to be able to apply for different grants and stuff. Um, but we're not, we're just now getting to the point where we're applying to government grants, um, and we're getting feedback which is... which is really good. So there's something called an STDR or which you apply for early on and you submit a budget and what they do is, that they'll grade you... um, and whether or not they think it's interesting, they'll do the first year or otherwise they'll defer the in the second year. So most of the time they differ for most of the people, um, in their first year. And then they talk about, you know, they look at you the second year we actually got granted the first year, which was really nice for us. Um, and so we're going through some of their feedback now and they say, oh, well do you need to hire more people in your budget? So this is some of the things that we need to be doing to build up the team and then the online presence and stuff.

Interviewer: I want to know more about the start-up. When were you founded?

Respondent: Uh, we were founded, I think officially.. um... late last year, so maybe around December or something last year and like as an... as an official entity, but, but we've been working on the project for three years now. I've been on it for two and a half years. Um, and then yeah, there was a team before that kind of did very, very early stage testing and uh, yeah, it's been moving along since then.

Interviewer: And how did you get involved?

Respondent: Um... through the MTM program. So the, a joint program between Berkeley and UCSF. Yeah, so to it was my... um, my capstone project was submitted project to the program through MTM

Interviewer: Yeah. And how did you then decide to take it past the MTM?

Respondent: Yeah, so the, the masters is pretty short. It's only one year, master's. And um, I felt like I... I had a good amount of experience but to actually get what I wanted from the education, I felt like it was still part of my education to keep going on this and keep learning the subsequent steps of, you know, bringing a device to market, which is the idea of the whole... this masters, just to learn how to do that. And so the... the doctor that I worked with Insoo, he went through this whole thing and he went through the bio-design, a Master's program at Berkeley or Stanford, which is some of the program to here... um, and so he has experience with entrepreneurship and all the steps you need to take to get a product to market. So he is, he's a good mentor to be under this whole time and so I'm still learning quite a lot on how to do all these things.

Respondent: Um, and then he sort of guiding the high level strategy of how to move things forward. So that's why I stayed because I think I thought it was a very good experience and uh, there was a job that popped up at UCSF that was, you know, I could keep working on this project and other projects in parallel and um, and get paid for it even though it's not very much. Yeah, I see it as like an extension to my masters and now after being UCSF for about a year and a half, I think I'm ready to go somewhere else and, and ideally still be able to work on this. But um, I think that level of learning that the rate that I went to them and learning is much lower now than it was before. So are they going to learn faster and industry and hopefully be able to apply it all my life.

Interviewer: So knowledge on the project, would you say then that your full time job or being at UCSF?

Respondent: Uh, currently I think it's being at UCSF since I have other projects that I have to work on. And so those are a potentially also spinning off into their own thing. Um, some projects, uh, leadership is not as good as, as with this doctor, so it's kind of kind of not as beneficial for me because I'm not in the position of being able to, um, to make those high level decisions yet. I'm not sure what the right move to do you when to do these things, what to apply for, whatever. And so I need that guidance. So unless I know that there's a, a leadership that's able to guide the project through, then I'm not necessarily willing to invest as much of my time in it because of it might just not go anywhere and I don't have the skills to actually lead it all the way and, you know, I know that. So, um, so yeah, I'm, I'm, I'm still learning a lot and um, um, I'd like to transition more towards just working on this project until I'm done with UCSF, um, and less on other projects. Um, but yeah, I think that's sort of the position that I'm in right now, but definitely technically still a UCSF employee. So I have to go to all your meetings and do all these types of things and I need to do. So.

Interviewer: What did you think? What stage is that it now? So you have launched it. Oh, you have founded the project, but you haven't launched the product yet?

Respondent: Uh, no, we haven't launched the product. So we, we've gone through, there's different parts of the device. So there's, um, there's what we call the tissue and um, product or the tissue device had interface like the, it's, it's a tissue manipulator, what we're building basically. And so one end is the ergonomics side where the surgeon just grabs and manipulates everything. And then the other end is the business end of the device where, uh, the actual grabbing happens and that's what we're trying to sell is that we're divided where we're building this, uh, a traumatic tissue manipulator, so tissue that are affiliated it, that we'll move tissue around without causing any tissue damage. And so that part is with, um, I think we've reached a point where we're ready to send it out for manufacturing. So we're currently looking for a manufacturers that will make the heads were calling them the heads for us, uh, and then we're redesigning part of the handle right now.

Respondent: So we've gone through a, like we've stopped a couple of steps back on the design of the Ergonomic handle, uh, and then once we finalize that, uh, we think that we'll have the two parts with advice ready and then we can go through what's called verification validation testing and validation testing, um, to make sure that the device meets all the

requirements, uh, before launching it to market. So you need to do a device, a sterilization, uh, you need to do sterilization validation, which means you need to make sure that the way you're sterilizing everything is, stays safe. Uh, so after he put it through this realization when transition and you test it and see if there's a slow enough level of my, you know, bacteria, whatever, I'm pathogens in there. Um, and then you do something called, um, bio compatibility testing where you test all the materials and the device and see if they're compatible with the body and the level of exposure that the body is seeing.

Respondent: So for us it's going to be surgery, like it's going to be in the body for under 24 hours. So that's category in and of itself. And you test this, this, this for that category. And so there's different tests that you have to do for different levels of categories. So implants will have higher level of biocompatibility testing that you need. And so that's one thing. And then there's something called bio burden testing, which is where you have to make sure that where you're assembling your device is a continuously tested, uh, like every eight months to make sure that the environment doesn't change and there's not new pathogens that are surprisingly, you know, introduced to the system that you haven't necessarily accounted for down the line. So you do buy a burden testing to make sure you have a controlled environment. Um, because you've already tested the sterilization validation.

Respondent: You've done that. So you know that with this assembly set up, the sterilization is OK, but if the, the, the assembly set up changes and there's more pathogens, then you have to retest, do sterilization. So that's why there's a continuous testing called bio burden testing to see that you're continuously monitoring your assembly set up and then you don't have to Redo your sterilization testing that you do one time because you know that with this setup it's OK. But if that changes, you might have to go through everything down the line and recheck that everything is OK. So there's a bunch of different steps that need to happen and I'm learning all of this and I'm trying to figure it out, all the manufacturers to talk to and all that. And it's a very small team again. So we don't have a whole lot of funding yet.

Respondent: So all the grants that we're applying for going to allow us to hire someone that will take care of the quality part. So, you know, made sure that everything is standardized and made sure that everything is tracked to make sure everything is whatever industry standards we need to hire consultants to figure out how regulatory pathway starts with the FDA we need to, and we have a good idea of all of these things, but we have to actually put it down on paper and start talking to the FDA and it's not like homework where you can just go and get your grade and change everything. You have to do it right the first time. And so that's, that's part of why we need to hire all these consultants and make sure that we're doing everything right. And so that's sort of the steps that we're on.

Respondent: I think we're, uh, we're about to talk to the FDA. Um, after we finished talking to the regulatory people were doing something called a pre-submission meeting with the FDA. And so, um, that's to confirm that we're on the right path and then apply for the FDA, um, you know, pathway that we choose. Um, and then, yeah, depending on those topics, we might have to do more animal testing if they think they need think they need

more data than what we already did. Um, or uh, we can do some cadaver studies to make sure that all the ergonomics field right everything is OK from our point of view, from the, you know, design development point of view to make sure that everything makes sense for the surgeons when they're using the tool. Um, and also get more data and you know, that could be useful also for regulatory purposes, but I don't know how useful is, but it's going to be because you want to test on device tissue usually to check for damage. It's, you don't really get the effect with tissues.

Respondent: So the approvals on design freeze for at least half of the device, which, which we did over the last year and a half for the head. That was a lot of testing. And we're actually in the process of patenting the process because we don't, we came up with a geometry that works for the head. Um, but it's not a conventional patent approach in that it's not like, uh, there's not a lot of theoretical background behind it. It was kind of a trial and error until you reached the right solution and iterative design. And so we're patenting this with the idea that, well, we have like 80 plus different iterations of this and all the documentation for it and this is something worth protecting because of all the work that went behind it. And so we're getting a patent for this. We have a patent for the handle already. We might have another patent for the handle on top because we need some mechanism to actually introduce the head into the abdomen.

Respondent: Um, so the device, I didn't say this at the beginning, but the device is um, uh, for something called laparoscopic surgery. And laparoscopic surgery is a type of minimally invasive surgery where you cut a little hole in the abdomen well a few different holes and then you insert all your tools through the holes and you put a camera inside and you see what you're doing within the abdomen without opening up completely. And so that'll last for slower... or faster recovery time, less pain, less complications for the patient, and that's a kind of a newish type of surgery. It's been around for at least 25, 30 years. But this is the new part for us is this is the type of manipulation. So right now what we do, what they do is they have these little clamps that go in and grab onto tissue physically with just like pinching force and that causes a lot of localized stress on the tissue.

Respondent: And that can cause tissue damage that's not visible right away. And so when you go in and you have histopathology, a person that looks at the tissues on the microscopic level, they can see the damage, but you can't, there's no gross tissue injury. It's not visible, visible. So when you close up everything weeks later, something conversed and you don't even know. Um, and so those happen and those are complications that directly translate to in America, everything translates to dollars. So that's sort of the market that we tried to target as, you know, how do we pay for the device while this is how much money the hospitals are going to be saving. And so this is why our value proposition that makes sense to them instead of grabbing like this, uh, you have a little suction cup basically that has continuous vacuum, a grabbing onto the tissue.

Respondent: And so the worry was that the vacuum itself is going to cause tissue damage. And so we proved that with the, uh, with the pig studies that we did that that's not going to be the case. And so the worst injury that you can see is, um, there's a scale from one to four, one being the, the, you know, no injury for being very bad at around three is when you can start to worry. We never had anything below or above two. So we're, we're always

like good for the maximum possible amount of vacuum, um, that you can get, which is, which is higher, which is more vacuum than you would expect from what we're going to be powering the device from, which was a small section available in the or, and every alarm, which is a standardized pressure. So that's what we're going to be operating at.

Respondent: Yeah, I see. And it is you in the team.. and..?

Respondent: So there's me, there's um, I don't know that you've met anyone else currently working on the team, but there were, there was a team in my year with MTM, the two people with me, um, on my team. There's another team of students the next year that we got. So another three people, um, um, yeah, Austin chasten and Sherman and then, or sorry four people and Michael, um, and those, that team was very helpful to move everything forward and one of them chief and it's still working with me now. And so he's the other guy that is working on everything. That's on the engineering side, that's what he's looking at. The development, uh, of the business plan, the, you know, the pitch decks. I'm looking at all the grants that we should be applying for applying for the CTR and other government grants. Um, so he's doing all of that and I'm looking at most of the engineering, but it's still very overwhelming, like it's a lot of work and so we're, it's nice within UCSF because we have access to a lot of mentors.

Respondent: And so it's, it's similar to an accelerator, a program where, um, yeah, they, they set up meetings with mentors every week and you just go and talk to a bunch of different people all the time. Um, but it's a lot more hands off than that. It's a lot. It's a lot slower. So if you kind of have to do the seeking out by yourself. An accelerator, typically from what I've seen from a bunch of my friends who have gone through them is, is that it's a really intense, um, accelerated process where you're in a room all day and then they bring in really smart people from industry and then everyone just tries to talk to them for an hour and then everyday you get exposure to someone that's very high up somewhere in the industry like, Oh, you're talking to the VP of this whatever at apple or you're talking to very prominent people in the industry that are just giving you their time.

Respondent: And so there's not as much of these super high ranking people, uh, that show up at UCSF I think. But there are, there are a lot of really helpful mentors. Um, Dan Burnett, which organizes the happy hour, um, uh, he hasn't talked to us that much, but recently there was an agreement with UCSF that, you know, we're going to be sharing resources. I don't know exactly what that means, but maybe that means I can get more help from them. But, um, there's a few key mentors that I've been talking to for two and a half years now since I started, um, that have been super, super helpful, especially in figuring out all this verification, validation stuff.

Respondent: It was supposed to be a 45 minutes, like sit down and talk once and then, uh, we ended up talking for about three hours and we only covered like, you know, maybe half of what we needed to. Yeah. But, so yeah, there's a lot to figure it out.

Respondent: Then you also have the director. The Um, Insoo, he's um, uh, been working on this from day one and he's again, he went through this with a company called prescient now press and surgical. Um, and so they, uh, are they have a commercial product, know they're on

the market, they're selling stuff. And uh, there's a team in south bay that's working on this and so he's still a chairman and that company. And the more the company, the more hands off he became because he has a job as a doctor, so he's a surgeon.

Respondent: Um, and he saw his attempt to ever become a CEO because he just didn't have the bandwidth and allowed [inaudible] but um, the idea is to take over the project and hire a CEO and hire as many people as we can afford to get this moving along quickly. Um, and he, he's going to always be there to have that um clinical side of the device and the network that he has is really, really expansive and it's super helpful to have him as a resource.

Respondent: Yeah. And he was also the one that has, had been driving the project all along. So it was... he started, um, I think it was his mentor, Dr Harlow Clark who patented this thing, this idea in the nineties and then, uh, the patent expired and then, or we took it over or something. But anyway, it was inspired by that. Excuse me. And um, and so he started that two and a half years ago, three, three and a half years ago, um, and they started, you know, they had like boiled eggs as models first for tissue and they're sucking on different things. And it was weird and then it got a little more rigorous, but um, he's been, he's been pushing for that and entrepreneur and yeah, just very good resource in general. So yeah, that's, that's true.

Interviewer: Yeah. You described how kind of your motivation, if I understood correctly, was to join the startup, was to also learn more about this driving products to market in the medical world. Would you describe... or could you describe how that kind of aspiration influence, your work in the startup um your thinking how has it influenced the work?

Respondent: Um, in what way? What do you mean? So like how it...

Interviewer: So do you think it would be.. you would work differently if you were at another job were for instance you didn't feel like this is also a learning experience?

Respondent: Yeah. Yeah. So I feel like if, uh, if it depends on the job. So if I was at a very big company, I never wanted to start my career out in a big company because I am terrified of being in charge of this tiny little piece of this tiny little device and never really get to have any input or look at the big picture as you know, as, as a product I would be like I'm tunneled or forced into a corner of Oh you do this and then you do it. Well, and that's it. And that's, to me it's like it's a huge barrier and where I want to go, which is I want to learn how to bring. I want to learn. Like if I have an idea, I want to know how to make a product and sell it. Like I don't want to be the expert in how to reduce five grams and the tube of the blah blah, blah, whatever.

Respondent: Right? So I don't care about that level of detail as much as I think it's really interesting and I might actually enjoy it because I really love the engineering side of things. I think it's more valuable for me and more rewarding to know the big picture, which involves doing stuff that I hate, which is looking at the business side, having a glass of wine and mingling with very rich people. It's like, I hate all that stuff, but it's, it's part of it. And it's part of why I, I thought staying on this on this project, even if it's not the most efficient

way of doing it, um, a more efficient way of being maybe to go, um, and working in an accelerator or work in a company like that and um, and have a project there. But even then it's, it's less, it's less responsibility that's going to be given to me and it's a lot more, um, um, it's going to be a lot more up to the upper management to decide where my learning is going to go.

Respondent: Whereas here, I can really, I can really say what I want to do and take the guidance from all these mentors and decide, OK, it's much more of an entrepreneurship um mentality than a, you know, this is my job, you know, nine to five, whatever. And then I do what I'm told and that's it. Um, it's much more, um, motivating at points where I can say, OK, well, I'm setting my own schedule. Like, you know, sometimes I don't have weekends and that's OK, you know, it's just what it is. And um, it's, it's nice to kind of be your own boss, but at the same time, not having a lot of experience means that you're in the dark a lot of the time where you're just committing a lot of time and you're not sure if that's actually what you need to do. And sometimes you have to backtrack, but, you know, you can't just stay still and hope that, you know, you get the answer of why you need to do and then maybe you do it.

Respondent: But, so, so yeah, there's, there's advantages and disadvantages. And I think I'm getting to the point where there's so many unknowns that um, I can't just go in a certain direction and hope that it's gonna work because, um, there's too much risk involved in all the possible paths that I could be taking. Which is why I think I'm at the point where I'm OK taking orders, quote unquote, um, and being, being under someone that, um, that has more experience in the specific, you know, sort of divergent all the different hats that I can see right now. I need someone that has been at that intersection that knows which one is right and can guide me through the steps of the right path.

Respondent: Yeah. So for the engineering side and all the early stuff, early, early stage development side, I was very comfortable. I'm laying down all the possible paths that we can take and just talking to all the people that are involved in the project and talking to a couple mentors and deciding, OK, this is probably the best one we should know. Maybe we'll do this one as a plan B and then we'll have that one going in parallel. But this was probably good planning. Um, because I've done this a lot with pure engineering and my background and you know, doing that in Undergrad and stuff. Um, now that, you know, now it's more, uh, it's more involved, it's more, you know, that's just the law, that's law, that's what people expect from you there. There's a few different things that you need to do for the FDA.

Respondent: But the problem with that, with the FDA is that there are strict laws, but at the same time they're very broad. So if you don't have experience, it's just hard to know how to satisfy the FDA. And so when I'm talking to all these people, I'm like, OK, just give me a template of what I need to do with all the steps from another project and I'll just follow them. And then they're like, well, no, it's, it's literally every single project is different and every single project has its own path that you need to figure out. And so not having any useful examples to follow as so much harder because again, that gets. It's so many unknowns that like, for example, for example, just to make this a little more concrete, um, um, a lot of devices will decide to use a certain type of material that the FDA is super OK with.

Respondent: Um, and so they make this, this device really complicated shape, whatever. And then they say they don't need to do, um, um, biocompatibility testing or something because we've used this material already and then they go down this path and it's great and they go through FDA and then other projects that did the exact same thing, he is not OK with this. You need testing. And so there's no consistency and it's hard to see. Like you need a person that has this FDA experience that will be like, oh no, no, this committee is going to be sweating like I like this. And so just choosing a path and going with it, it's, it might be super, super inefficient to just do that. And so it's, it's hard to, to learn, uh, the right way to do it without just messing it up. And I don't want to go through all that time to do something that's wrong and then go back and they'll go before I go back.

Interviewer: So what do you do instead?

Respondent: So instead we were trying to get funding to hire someone that will tell us exactly what to do and uh, and guide us through, um, you know, every step of the way, but we can't, we can just like, it's not enough to just get advice from mentors because it's, it's really almost a full time job what you need to be needed to create this plan and do it day to day. And so it's, that's, that's where we are right now is we need someone that is going to dedicate time to guide us through all of these steps.

Interviewer: What about it early on in the area that you, the engineering work, I would also mention there's a lot of decisions that you need to take in a lot of path you could have taken from didn't take. So how did you navigate that?

Respondent: I did it the same way that I've, I've dealt with most of my projects in the past. It's just that I, I kind of tend to just back calculate, um, what we need and so we have the needs that the device needs to accomplish. We have the functions and the, you know, all our constraints and all our objectives and um, we kind of moved back from the, from, from all of these. So, uh, for the head development, we needed to have a similar amount of force that you can have for a conventional grasper because it can't be, it can't just be like a super weak device that, uh, you know, it's not really as good and the doctors are going to be like, well, I'm just going to use the grasper because it's easier to use. So we needed something that's at least as good. So first step is to figure out what that is.

Respondent: And so we do that, we find the number and then after that we kind of go one step back and say, OK, well what's the, what's the geometry, the maximum geometry? Because more force our devices to be bigger. It just happens that that's how it works. So we needed to be bigger. So how much, what does that, that dimension, how big can it be, and set up all these big parameters and then work backwards on to the best case scenario. Um, and so that's, that's like iterative iteratively. We try to, we try to optimize really what we did, we want to optimize for the force and so we try this, try this, try this material, this material, and then we try this surface, finish retry this geometry, these features. And then every week we had like four or five different durations and then we just test and test.

Respondent: And um, and so that's, that's one way to do it in another way would for the handler for example, is well we need something that functions and we need it to be simple and we to be cheap and we needed to be, uh, you know, it reproducible, um, in a, in a high s or

large scale. And so what we do is we, again, start with all the minimum requirements that we need. And then, uh, just build something, build something that's really, really simple, get a proof of concept going and then make it better. And so that's kind of a, um, it's, I guess it's a similar path where, yeah, where you just have something that sort of works and then you just make it better every time. And so that's where we are with the handle right now. We have to do a redesign for part of it.

Respondent: Um, so we were at a design freeze, but then we realized that there was a requirement that we need to add it so we had to go back and redesign. So that's part of what I'm doing now is, is the redesign for that handle. Um, and so yeah, it's, it's just, it's simpler with engineering because there's defined tasks, there's goals that I need to achieve and um, there's numbers that I need to reach an optimized for. And so it's easier to take baby steps towards that direction. Whereas with the FDA, it's like you need to build this portfolio of things and you need to pay a lot of, a lot of money to a lot of people to get these tests done that you may or may not need depending. Right? So that you can spend easily \$15,000 on a test they don't care about.

Respondent: So it's a decision where it's like, well, do we do it or no, like maybe they're going to ask us for it and if we don't do it and we present our case to the FDA, then it takes six months to take the, make the number of tools that we needed to get tested, get the results and I'm presuming segment actually the FDA and then for them to look at it again and go back to it too. Like if we had infinite money, we just do everything and we submit everything and it's like, OK, this is what we do. Um, by the way we, we're, we're, we need to figure out how lean we can operate at and what's the least amount we can comfortably spend. Um, and so present a good case. And so that's very hard to figure out when you haven't done it in the past. But again, for engineering it's, it's, you know, it's, do you have that number of that pressure? Do you have that forced you have that dimension and then if not, just work towards making it better and with every iteration you make it better.

Respondent: Yeah. So those are, it's, it's kind of, um, there. It's easy for some of them it's harder for others. Um, for the force that we want to get from the device again, it's like OK, well it has to be at least as good or better than conventional graspers. So that's one of them, uh, for the dimensions of the most, how big can it be? Well, there's only a certain size of a, of a cut that you can make and the abdomen and there's standard reports that they put in a. So there's five millimeter to 10 millimeter, 12 millimeter. So ideally every one wants to use five millimeter ports. Um, so that was the first constraint. Is that, what was it possible to do five millimeter? And we try, we try. It's, it's very difficult for us to do five millimeter today. It's going to take way too much effort.

Respondent: Can we do 10 millimeter or 12 millimeter [inaudible] [inaudible] is the same from the doctor's... from the doctor's point of view because they still have to stitch it up five super easy. And so, um, we say, OK, well I guess 12 millimeter is our limit. Can we do 12 millimeter? And then, yeah, OK, we can do them when I'm here, what can make it bigger and like collapse it down because we actually needed to be bigger than 12 millimeter. And so that's, that's sort of the, the steps that we go back and forth with the, with the doctors to see if we do surveys. We asked like, OK, well if this tool can only, you can only

use it but the 12 millimeter port, do you think that's a bad thing? And they're like, oh well I'm going to use one anyway for this or whatever, wherever they say.

Respondent: Right. So we try to gauge if that requirement is a go no go decision type requirement. Um, and if it happens to be a no-go than you know, we just have to invest more time and resources to get work with uh, another constraint. And so, um, that's, that's another one, another one would be, uh, be uh, I don't know, a more technical, less, uh, less related to the actual clinical side is you know, what type of material we want to use is going to be a disposable device or re-usable devices are going to be whatever and that is a little more complicated. Um, and it involves looking at the business plan, looking at, well, how much money we're going to be making down the line. Does it make more sense to have this be sterilized double the time. Um, and so you kind of get rough estimates of manufacturing costs and sales, like how much you're going to be selling this for and how much money you're going to be making from this.

Respondent: And just making a huge spreadsheet and figuring out OK, well disposable or not disposable and seeing or even then like all of that, that might not matter as much as Oh, well this is what doctors want to use. Like they just want to open up a box or the hospital rather because they're busy. So this is what the hospital prefers. I just want to open the box using devices over that easier and so there's a trend for a more disposables right now. So that's part of the influence of the decisions to say, OK, we're going to do that.

Interviewer: What about.. you mentioned the handle is ergonomic. I would imagine that's difficult to set up specific metrics for that?

Respondent: Yes it is. So there's a lot of studies that we do, so we don't, we, we can't afford to. Sorry. We don't, we don't do... we look at, um, there's a, we can't afford to set up a huge user study with a device that's not even a design from the not frozen, right.

Respondent: So we wanted to make our prototype inspired by other studies that have been made with other handles and so we either try to imitate what other handles, like the shape that they have, the types of buttons that they have, the types of knobs that they have. And then within the group, um, we have a surgeon to surgical residents, um, that were in the group. And then there's a few different surgical residents and surgeons that we have access to that we just, we kind of survey and ask them, OK, well if you have something like this, we show them tools that exists already and ask them, OK, what do you like about this, what don't you like about this and where would you like this handled, mishandled or sorry, whatever this lever. And so we try to, um, we try to go from kind of broad, um, study data that we have from Ergonomic studies that have been done a around the world.

Respondent: And then once we have a design for is we actually planned to confirm that our devices good enough with UCSF. There's a ergonomic study research. Uh, there's like a group that does that. And so hopefully we can use that resource and do a little study on that. And we're, we haven't figured out how big it needs to be in to know the details, but the idea is to try and confirm with them that, you know, this is a good device and we don't have to change it too much or we have to change this or that. And so before we actually

send everything to, you know, large scale manufacturing them, that's, that's, that's what we needed to do.

Interviewer: That makes sense. So it seems like you've been using the resources at UCSF a lot, what other resources would you say you're using?

Respondent: Um, so the MTM program has been very useful for us, uh, with, with the students that we've had.

Interviewer: Um, so you have been talking to that of surgeons and also a lot of engineers, but I would imagine there should also be on other competencies in developing the project?

Respondent: Um, so the one big mentor, uh, is, he's the guy that works in South Bay a, he's a consultant and does a bunch of jobs for a bunch of different companies and so he's been very helpful, um, throughout the process. And then otherwise, I mean, it's just other manufacturers and, and it's not really a consultant, so it's more, it's more pay for service type of people that will give us goods. Um, uh, but yeah, we're, we, we were not at the point where we had the funding yet to, uh, to hire external resources. Uh, that's why we stuck to you says that as much as we could, which was really good that we had quite a lot of, a lot of help from their, um, released through there and uh, yeah, it's only now where, uh, we actually have a good, a good amount of money to spend until June from this other grant that we have and, and this is where I think it's going to push a lot of the engineering effort and the consultant consulting effort to get all the knowledge that we need to move forward.

Respondent: Um, but yeah, I think that's coming up. I would say I'm not exactly sure where the help is going to be coming from exactly. But you'll find it. Hopefully I haven't defined it before June. So that's the idea.

Interviewer: Yeah. So if, if I, what I hear you saying is that it seems like soem of the tasks that you need to do in order to launch have been kind of pushed forward because you didn't have the resources or the competencies to do it right away...?

Respondent: Yes, in part, yes. So a lot of what we're trying to do before we're getting this extra funding is trying to validate some of our hypotheses with, uh, with the head to actually get the final, final design freeze and we wanted to use the material that we think we would be using in industry, um, make, uh, make the head and test it with a device. So we don't, we only need like a dozen of them if that, uh, to test it in house on the test setup that we had to confirm that the force that we were getting from the other iterations of the device which didn't use the exact same material, we wanted to make sure that that was consistent and it wasn't any weird effect that, you know, maybe the other material has a very different surface finish or finish or have a different slightly different stiffness, have very different whatever, some variables that we didn't take into account. So we just want to make sure that the tool that are the material that we'll be touching the human body at the end is the exact same and has the same characteristics as a, what we had been testing what we did for the pig study and stuff. So we wanted to confirm that that's OK. And so we're trying to make some of, uh, the injection molded

parts that we need in house. Uh, so I was working on making molds and I'm doing all of that process and it worked. It worked. OK. Um, the problem is that there's a lot of inconsistencies with this, um, this process and anyway, it's kind of irrelevant, but the point is that, um, we were trying to go lean and trying to make all of these and try to avoid spending as much money as we can, um, because we couldn't afford to. And so now that now that we can, it's going into the direction of like, OK, we need, we need to, we need to spend that money anyway and um, and this is a good way to do it. And so I'm talking to manufacturer is trying to get it done. We can do it before. Yeah. So it's kind of the same but the, yeah.

Interviewer: How would you describe the types of methods, data sources and so on that you use?

Respondent: Um, methods in terms of... what do you mean?

Respondent: So like do you use the methods, for instance... yeah you have this kind of goal and then you figure out how to reach it. Okay that's maybe not... But I'm also thinking for instance fo you use the methods that you learned at school you utilize. Or do you for instance look online... to know like how do I do this?.. or?

Respondent: Uh, yeah. I mean, there's so much, so many things, uh, that like somebody asked myself this project, a lot of it is trying to figure, figure out these things that I don't really know, try to figure that out online. Um, how to, how to manufacture things with a CNC machine as an example. Like I've had to spend quite a lot of time learning how to do that online practicing on my own again because not only because we didn't have the funding, um, but because personally I thought that would be a very useful skill to have as a, you know, as a designer to be able to make molds and make all these very intricate parts very quickly. Uh, if you were to do that in industry with the level of detail that we would require, you know, it's going to be a very expensive, you know, eight, nine, 10,000 a part already \$10,000 a part.

Respondent: Um, and it's going to take, you know, maybe a couple weeks to get it, to get it done. So, uh, being able to do that for my own time and very little money under \$200 is a very good, useful thing to have. And so that's part of, part of what I, what I had to do was go on, go online and try to find these resources, are learn how to CNC and learn how to do these things accurately. And then another thing would be, um, you know, how to, how to brainstorm for all of these ideas and how to get the best, uh, the best ideas forward and try not to neglect all the bad ones because you can always combine. It's been, it's, it's been a few times where I've seen that you can combine something that seems really silly with something else and make it really good.

Respondent: And so a lot of it has been to just have everyone sit down in a room and just throw out ideas and write stuff on the board and just by the end take a big picture of everything and just digest and go back. And uh, and when I'm, when I'm sitting down to design, you know, I'll think of what I think is the best idea and combine a combination of different ideas and then everyone else will do the same. We reconvened and we kind of try to reach the best conclusion together. So that's one way that I think creative design a like convergence towards an idea. That's one way that I've, I've, I've done it before and that's, that's really I should say that's really when a, it's something that's kind of very

abstract and important that we need to figure it out. Like something that we don't have a good idea for like what is the head gonna look like in general, but when it comes to, I don't know, like we need to make a complaint to design a setup, a Jig to measure the test, the pull force for the head.

Respondent: Like how much, how much force it actually pulls. Like we don't do all that. We just sit down with like, OK, well what are the minimum things that we need? OK, I guess we could buy those, we can buy this. And then it takes a few hours and then we're done. Like we don't have to make the cheapest, most optimized, whatever, everything right. And most of the time you don't have to have these discussions where you sit down, you have, you know, the nice super friendly environment and you get all these necessities like that's really good for when you have abstract designs that you're starting from scratch, from scratch. And then there's, it's, it's, uh, it's worth your time because it's a very long process. But for most of the things is like, oh, we need to design this little thing. Like it doesn't make sense for everyone to sit down in the room and have posted notes and write everything on the board.

Respondent: And it's like, it doesn't make sense. It's just a resource management thing. Um, so, so yeah, very different ways of approaching different issues. Um, if I just have a solution in mind and I think it's good enough, I'll just do it right away cause it's, it's the most efficient way of doing it. Um, but um, other than that, I mean resources. Uh, I try to try to talk to my, to talk to my coworkers as much as, as I can to see, you know, if they've done similar things, I'm trying not to reinvent the wheel and try to look up a try to open up, have a device that I opened up the other day, uh, like I took apart and saw how it works. Um, so that's a great resource actually I'm into will take me into the or, and uh, we'll grab all these different tools that he thinks are useful for me to look into.

Respondent: Um, things that are ergonomically good for the surgeons are like, oh, I forgot how this works and it's, I opened up if I look and I'm like, cool, cool for bar mechanism, blah, blah, blah, blah, blah, whatever it is, and then reverse engineer that and put it into our device. Um, so yeah, it's, it's very different. It's very creative being in this super early stage. Uh, it's a very, very creative process and uh, it's not, it's sometimes to, to abstract, um, which makes, it, makes me think that I'm not doing it right because I could be doing it so many other ways.

Respondent: You just have to choose, you just have to set a deadline and just go with the one thing. Um, it's hard sometimes because I'm just there, I'm like, shit, well maybe I could do this better, but it has to finish my next Tuesday. So I guess I'm doing it now. Sometimes you don't know, sometimes you just don't know. Um, when, when we're not talking about, um, about a defined goal that's measurable amount of force or, um, or anything, you know, how, how, how long, uh, how much, how many cycles are seeing so survive. Um, whatever it is. Sometimes it's just like, like the ergonomics. For example, right now we have, I have incidents, opinion, I have Isabelle and, and, and I had Sherman's opinion and a couple other doctors and that's it. And they're like, oh yeah, that feels. But they're inherently bias already. It's just, it's a shape that we chose and right now that's what we're going with.

Respondent: I don't know if it's the right shape yet. And so the more we, the more we move along, these are just kind of are like, they're not checked as done, they're just kind of maybe the maybes that are going to be tested later down the line. But it's something that's there. It's useful, it's super useful to have because it's something they can go to a presentations and conferences with and be like, this is what we have and it works and you can see, you can play with it. And the value of having that is huge. Or instead of being like, oh, we don't have an optimized advice because like I said, like we're not going to make it. So it makes sense to have all these things and people understand, especially, especially in the field that, you know, when you're, you're not commercialized yet, but your design is probably interchange hopefully.

Respondent: Um, so yeah, I don't know, sometimes it's kind of stressful and I feel again, I feel like if I were an industry, um, then I would have a lot more of these answers, but honestly I don't know that like the more I see what my other friends and industry, the more I wonder like, I don't know that they know either, you know, you just have to go and hope for the best sometimes when you don't have these easy to measure the goals. Um, all you can hope for is the experience with your mentors and the experience that you get from consultants and other word for it.

Interviewer: So what about the whole project? How would you define the success? Like when would you think, OK, now I've successfully done this start-up?

Respondent: Yeah. I don't know like where we have, we have a big gantt chart and we have a big sort of master spreadsheet of the goals that we're setting for the year and we have like a five year plan but because it's still the commitment aspect of this project specifically is not as firm as anyone would like. Meaning that I don't know that I'll be able to work on this. Um, you know, if I find another job, that's what you see. So if I don't know that Jason is going to be able to work on those, if he finds another job, I don't know that, uh, well I know that Insoo isn't going to be able to invest more in this one has, I don't know if we have the money to hire more people.

Respondent: So. We have like an ultimate, ultimate sort of big idea, um, of where we want this product to be and that's to have a company stands on its own two... on its own two feet and have a commercialized product. And ideally, um, because we don't see and none of us see this as being like our life project is to have that idea be sold to a big company that, uh, would, would acquire it basically. And so, um, we are in talks with some big companies right now. Um, and you know, that's going on. But, um, that's, I think the, the, the idea is not to rely on that as the ultimate goal because it kinda changes the way you run the company if you're just relying on a point in time where you burn out and out and that's, you know, if you're not acquired by then you're done.

Respondent: And so the idea is to be self sufficient at least as much as we can constantly and not go down in terms of all our resources until we know that we're going to get acquired, um, or not go down in general. Like ideally, obviously with the company you want to keep growing. But um, if that doesn't happen then OK, you know, we, we, the idea is there's two ways you can go about it is one is to try and stay afloat as much as possible and another is just to ignore it and hope that, you know, we keep her appearances until we get bought out. And so that's the two philosophies and that's what we're trying to avoid.

The second one, which was to ignore it and be like, no, we have to be self sufficient. And you have to call it, we have to cut this or this person or resources or whatever and try to stay afloat as a company, um, because we do think that the idea and the device and the technology is, is really good in and of itself. But we realized that if it's a company with only this device, it's going to be very hard to be a very profitable, um, so the plan, because we're going to be... we plan to be sustainable, um, because that's just, it's not the more realistic point, but it's this more conservative way of doing it, um, is to say, OK, well this company is gonna. It's going to stay in and of itself. And if something is, if a company acquires us, that's great. That's like an extra. And that's great. OK.

Respondent: It's hard to answer that question. I'm like, what? We're trying to have more conservative approach and we're trying to stay alive as long as we can. And that will involve a different way of thinking then saying, oh, we just have to stay alive for another year. And it'll mean OK, maybe we need to start thinking about another device, maybe the interesting thing about different heads, maybe you need to start thinking about different product launches that we need to do a bank and sit on this side until someone buys it. And so that's, that's the idea that we have right now. It might change me or I don't know that that's the philosophy that we're following right now. Um,

Interviewer: So when I asked you earlier, you mentioned that for you, a big part of the reasons for joining was that you wanted to learn something new. And so I was just wondering if... you know, now it seems like you're learning experience is kind of saturated. That for you maybe, the goal isn't so much where the company is, but where you are. That's why I was thinking...

Respondent: Yeah. So, so that's the thing. I don't know that I can, it depends on, again, all the funding that we're going to have. Um, I personally, I, I can't work on this past 2019 in my current visa situation. That is a hard stop for me. So I need to have a visa other allow me to stay here and work here and so I, I can't, um, keep doing it. If I could, it would be a different conversation. I hadn't really considered it because there's no point because I'm not American. And so, um, I need to find a job that will allow me to keep working on this in parallel. And that's I think the best case scenario for this project right now because I otherwise I work on this whole 2019 and I'm out and I think that dies at that point. Not to say that I'm so great, but there's just not enough people working.

Respondent: Um, and so yeah, so that's, that's part of why I think I also need to move is that, you know, it just doesn't make sense for me to, to stay with the UCSF because they won't sponsor the visa that I need. Um, so yeah, I... if you ignore that then, uh, I think I would probably stay within the company and um, potentially even just leave US. Not really work a work full time on that until we get enough funding and then, and then figuring out... figure it out from there. But I'm again, I'm at a state where I have to weigh all my options and if it's only the fact that, um, I have one and a half years left here than I'd rather learn faster elsewhere than stay at this, at the rate that I'm learning and have to leave in 2019 because it's a very risky thing. Just just hope that this works also. But I, I would like to take that risk if I, if I had the chance, which right now I don't.

Respondent: Um, but yeah, it would've been a nice thing to do as a, you know, a fun entrepreneurial project even if it feels, you know, it's just, it's a good learning experience. And it, again,

it all depends on the funding. If we can, if we can hire people to learn from them and know that it's great if you can hire, um, me and sponsor me somehow, which I don't know if that's legal even I don't even know. But um, but yeah, so that's, that's sort of the idea that we ignore all the visa things than um, than it all comes down on the funding. Like if it's, if I can learn fast here then I would probably stay within the company and think you'd going. But right now it's, it's too risky for me personally.

Interviewer: What if you were American and you kept working on it and at one point and you felt like you didn't learn something new?

Respondent: Um, that's a good question. I think... Um...

Interviewer: It's because it seems like it's really important to you...?

Respondent: Yeah. Cause, cause then it's like how am I investing mid twenties? Um, and it's a good question. Um, yeah, if I really don't feel like I can learn something new and that the company is profitable, then I would probably try to find someone to replace me to keep the company going and assuming successful and, and, and move on to other things personally because I don't, I don't want to stagnate. Like the most important thing for me is to just to have my work be exciting. If it's not fun then I'm not going to work on it. Um, and so I would, yeah, if the company is successful and, and you know, I can push it at least to the point where I can replace myself with someone else, then I would do that.

Respondent: I would power through and it would be boring for a while, but then, you know, I wouldn't, I would do it, um, and move to something new. But uh, if, if it's fun then yeah, I keep going and keep learning as much as I can.

Interviewer: There probably wouldn't be a time like that. But I was just curious.

Respondent: Maybe who knows?

Interviewer: What about, you mentioned there was some stuff that was maybe out of your kind of field of expertise, like drinking wine with it and they're doing business plans and so on. And it seems like, you know, your own personal learning experience from this start-up that was one of your main reasons for being there. So what do you think about having to, having to go through all of that?

Respondent: Yeah. So what I've learned is that when I look at myself like five years ago, um, I never thought I was going to be doing anything apart from the pure engineering side of things I could never imagine me doing anything else on. And this was me on my... on my experience in Undergrad, in, in the students we have like student design teams I've ever worked on building race cars and snowmobiles. And that was a really fun project. Um, so I couldn't really see myself doing anything else because I had so much fun and I was learning so much every day. Like honestly, I was probably learning more every week than I am learning today, every month. Like it's insane. Um, and so I was learning so much, having so much fun and uh, and the last two years someone needed to be a technical director and captain of the team and I was probably, me and me and a couple

of people were going to be, you know, it made sense that we took over the team. Um, and so we have hands off of more hands off than they appear engineering side and more do more of the managerial side, look over people's designs and do the, you know, the, the director type work, you know.

Respondent: And so having a, having a taste of that really made me appreciate that side of, of running a project. And I think that's where I see myself going now. I see myself ideally having a team of people working under me on the engineering side still on the engineering side. I hate the rest still, but the point, the point of all this is, is that, um, I, I might start liking doing all the other things like cars five years ago again, I didn't think I would like anything else, but now I can definitely, like I want to do that managerial side of things where I'm running the engineering team and um, you know, looking over all their designs, having a hand in all of the technical decisions, um, but also kind of giving them the autonomy to build all these sub sub-components on their own.

Interviewer: So what is your approach when you do something that you haven't done before? I mean something new and you might not have a textbook telling you what to do? For me at least it will be very different from school.

Respondent: Yeah. The the way I've done it so far because that has happened already in a couple different aspects of the project that I'm working on. It's um, I'll let the people do like I have an idea of what it takes to write the code or you know, developed this interface or a developed this electrical board or whatever. I have an idea of the timeframe that it takes to do all these things. Um, and I, I can have a good enough conversation with them to figure out, you know, the big picture. And so what I'd like to do is to meet with all these engineers once a week and go through all the problems that they're having and go through the, like as much detail as I can understand.

Respondent: And if I don't understand, ask them to explain to me what that is and why that's an issue and why it's taking so much time. And why they think that's going to take more or less time. And so it's kind of learning through them, um, how to do all these things. Um, and I'm, I'm, you know, I'm never going to be an expert at what they're doing and that's fine as long as I can understand again how long it's going to take, how much they can do, what's the extent of, what's the range of capabilities that, that, that can be done because that's more important than what they can do because it can be done. Then maybe we can pull resources from somewhere to get it done. And that's the differentiation between, I think I'm being just in the, in the, in the, on the technical side and being a manager is that you don't necessarily understand the range of what can be done and you only see what the engineers can do.

Respondent: And the engineers are always kinda tunnel visioned into what they think they can do. Um, and they, they tend to ignore what can be done in general. And, and when they sit down and they figured out like, oh no, Oh, this guy does this, this guy did this. So their main focus, what they're doing right now and uh, how fast I can do it, et cetera. Um, so the point I'm trying to say is eventually they get the whole picture of, you know, oh, this person, they're doing this, this person that is doing this, and they're so specialized that they know what can be done. Um, and I want to get that perspective from managerial position to be like, oh, well, where can we pull resources to help you get more than

what you're doing now? Get done one, now you're doing now, um, and, you know, help, uh, help her, you know, healthy and this other guy, did this help us, you know, let this guy help you do this, blah, blah blah. Um, so yeah.

Interviewer: So then how did you then prioritize between the different things, like you have the ergonomics, I guess it's important, but it's very different from maybe the tissue when you prioritize...?

Respondent: I think I prioritized based on the next milestone every time. So I tried to look at the big picture all the time, but most of, most of the immediate decisions are driven by, uh, whether, whether or not this stuff can be done on time for the next milestone. And so, um, for the longest time the handle of the redesign, we knew we had to do it. Um, but the last year and a half we just ignored it because it didn't matter really, it, we had to, we had to get stuff done for the milestone, which was at the time of the pig study. And so put everything in the back burner and focus all our efforts on the head and so make that work and make all the iterations and make sure that that's ready for the big study. And then once that's ready, we're good, we can focus on other things.

Respondent: Um, and so it's, it's just, it's kind of day to day almost what I would say we do week to week to week. You kind of reevaluate, um, the priority level of every goal. Um, it's, it just depends on, on what you have to do next. For this project I have now, um, it was set on the back. I was, I wanted to work on this product. I wanted to work on that. Pray this week I'm mostly but then something came up and next Monday where we have to present or Tuesday to present at a conference in LA for this other project. So now my efforts on that, so this, the Olympics, sticking it back a step back for a little bit for me until I managed to get this completely out of the way, get that polished for the demo and then I'll go back to after.

Interviewer: So generally week to weeks?

Respondent: Yeah, week to week. It depends.

Interviewer: And is there usually a consensus in the team, like, OK, this is what we need to put all of our efforts on or...?

Respondent: Um, a lot of it is deferred to me because I'm the main engineering person and either that or I'm the lead in the team and so I'll, I'll try to redirect everyone's efforts to this or this goal for the week and most of the time it's, it's not that important that I need to, you know, I need to focus on them. But for example, um, you know, a month ago we didn't really have anything for, for this, this other project track alarm project. And so I just told the other guy, but like, OK, just have the software demo ready by the end of this week just because we want it to be demo ready. And so once a demo comes up, we know it's good. And so that happened three weeks ago. Next week we have a demo we didn't know about.

Respondent: So now we know, we know we have, we have backups ready and then the rest of the time, you know, you can work however you want on these other goals that he has to, he

has to work on. Um, and you know, we kind of talk every week to see progress on everything, but it's less, it's more fluid most of the time, but when there's something imminent coming then you, you prioritize on that would be an important thing. Would be, that'd be a good presentation though for Lamprey. Uh, one thing that was kind of funny, it happened a few times is that suddenly we have to spend a lot of our funds because, you know, the, the grant expires in two weeks and so over the summer I had to spend like \$35,000 on a bunch of different equipment because I was told it was acquired, like OK, well I guess that's my priority if I spent two weeks shopping instead of. Yeah. Um, so yeah, so that was like, OK, well everything is on hold now because we have the money to spend. It's just things like that where it's either a presentation, it's either the things study and stuff's not on schedule, know we just need to re re allocate resources to get it done. Um, or yeah, like a conference talk or like, um, someone visiting, um, you know, that we want to demo this for whatever. Yeah.

CASE 4.2

- Interviewer: So when you have kind of university, oh, your university's been apps around medical devices or just medical device that of like how do they kind of navigate these. Sometimes have these conflicting demands, but what I'm interested in from you is more you experienced as an entrepreneur
- Interviewer: So how did you get involved in the case?
- Respondent: Okay. So, um, the, uh, this is a longer story, so it ties into my other entrepreneurial work. Okay. Yeah. Uh, I had done a fellowship at Stanford, uh, in the bio design program and this was done after my clinical training that a fellowship then led to a startup of a surgical device called a pressing surgical, uh, which I cofounded with some of my bio design fellows. Um, I had actually taken a break from my, uh, academic medicine path in order to push this company forward for awhile. So it was full time when I worked. It was full time, you know, obviously I did, I did some, I took some on call shifts to keep my clinical skills up and that type of thing and also to pay some bills, you know, that type of thing. But, uh, it's fair to say that I was a full time with this for at least a year to a year and a half. Um, and then in that function I functioned as the CMO; the chief medical officer.
- Respondent: Then, uh, you know, the company is still going, it's doing great, but I always knew that I needed to come back to academic medicine. That was my calling. I really wanted to come back to it. And maybe apply some of my lessons that I had learned in medical device design entrepreneurship into my academic career. So, uh, around 2013 or so I came back and slowly kind of got reintegrated, became faculty here. And then that also meant a transition from the company from being full time there to becoming, you know, a board observer, a consultant and that type of role. Um, so as that transition was occurring, uh, I was also kind of trying to figure out what other new projects can I start to think about that start as a, as a faculty member, as a, as an academic surgeon, as opposed to the privileged time that I had during the fellowship where all I had to do was, you know, invent stuff with these other people and have a good time and work on this full time.
- Respondent: So, um, luckily the idea for the lamprey device had already been given to me by one of my clinical mentors. The core principle, I guess, if you will, was already invented. Um, my uh, uh, one of the retired professors and surgery who was my mentor, he had already filed a patent and had invented a device that is based on suction to grasp soft tissues. Um, and uh, it was a fairly rudimentary design but the, but the ideal was there and there was a great foundation. So he told me, hey, you did this fellowship, um, and you now have experience doing this company stuff. Why don't you see what you can do with this idea? I'm obviously, I'm retiring. I don't have, you know, I don't have that skillset. So see what, see what happens, just play around with it. And really, so I do appreciate that very much. I think it was very generous of him to say, Hey, let's share in this idea and see where it can go.

Respondent: so I started working on it a little bit more. Um, and uh, as I continued to sort of think about the, um, the role role of this technology, the, you know, the mechanism for modern day surgery because of the patent was sort of old. Um, I thought maybe it's the best to be trying to design a device that's using that mechanism, but more, uh, applicable to minimally invasive surgery. The stuff that, you know, modern surgery likes to do more of with smaller incisions, you know, more fancy stuff. What was the original, it was designed for traditional open surgery, so where you make bigger incisions and you'd just use it as a standard pencil like instrument. Uh, so, um, I started developing a bit of a. I'm using the processes that I learned in design program, which, you know, are things that I'm sure are immediate intuitive to many other people.

Respondent: But for the doctor it was not, you know, if the idea of where's the market, you know, is there a true market size, um, uh, what is the true epidemiology of this problem that I'm trying to solve? Um, who would be the main stakeholders for, uh, getting this kind of technology to, to fruition, you know, what would be the IP and the regulatory aspects of getting this project through. And so I built up the generalized idea of how I think we should move forward with the project. And I presented it to mostly within my department. There's an interested group of, um, you know, some engineers and a surgery faculty, uh, in medical device design. And um, as I was continuing to, um, uh, what's the word refined the idea or people started to come on board, you know, I had, uh, some research, uh, uh, surgery residents that were interested in this project come onboard.

Respondent: Roman came on board as a result of us taking part in the Berkeley MTM program. Um, and one by one and things just started to come together. Um, and so, uh, with the combination of mostly really clinical expertise and a really great mechanical engineering expertise, particularly with Roman coming on board since he's such a Wiz, it, uh, the project really started to move forward really quickly where we were able to do lots of great iterative brainstorming and designing and prototyping and getting to some final designs for, um, the, the, the truth, you know, the final embodiment of a, of a first concept prototype. We tested that prototype and you know, lots of bench top models and then ultimately wound up doing a pig study which turned out very successfully. Um, and uh, now we're at the stage where we're, we have all this great momentum and we're now in the university setting still and we're trying to decide where to go.

Respondent: And it was a little, I must admit, it may have been a little bit easier to make the decisions when I was first doing the company because I was not designed to stay at Stanford. We were designed to try to make an idea, go when take off and turn it into a startup company and you know, all of that thing. Now I'm at a stage where things are so great and I think ideally we would spend more time to try to really spin it out, but I'm now faculty and it's a little bit more difficult to devote that amount of time to this because you know, things like this deserve a fulltime energy if it's truly going to become a product or something like that. But having said that, we're currently at that stage where we're excited to see where the next step is. Um, and uh, uh, I think that the next logical step will be in

addition to trying to get some small business grants or whatever, I'm finding some partners that can work with UCSF, like maybe like a, an incubator that would be willing to kind of develop a list for, you know, actual manufacturing purposes and moving forward with like actually doing regulatory, um, uh, planning and submissions a actually, you know, creating a new, a real.

Respondent: Well, we've done some of this already, but creating an actual commercial company that will push this forward and hiring real staff and raising money and yeah. So that's the first summary. Right.

Interviewer: And so can I just go back to when you initially with their previous company decided that you wanted to try this adventure. How did you, because you also knew that you wanted to go back to academia. So what was kind of your inspiration or motivation? Yeah,

Respondent: Um, confusion mostly. Um, I would, I would say that, um, well that, that goes back even further, I, um, my academic career path in surgery involved going to a lab and doing a combination of basic science and clinical translational research in my field, which is endocrine surgery. Um, that's what I did when I was in my training when I did my research fellowships during my training clinical training. Um, and I certainly love it. I think it's great. It's pure academic research is really good. Like I think there's so much that society can benefit from, that society, can benefit from it, et cetera. I don't think it's the only way. Um, and uh, it was that concept to me didn't, didn't sit until one of my co residents, someone senior to me had also done this bio design program, came back and presented what he had done and I was blown away.

Respondent: I didn't even, it didn't even occur to me that you can affect medicine, that you can affect health care in this path with a training paradigm. But we're a grown up because surgery in general, medicine in general has training styles that are locked in very traditional and very predictable, you know, you do medical school than you do residency. You may do some fellowship or research stuff and then you become an academic usually the things that you were trying to be creative in and do research and are government funded basic science research or health outcomes research, you know, things like that. And I'm clearly, there's huge value in that. But, um, especially in the era when I was training the idea that surgeons and doctors, physicians, academics can get involved with engineers with a device design with um, uh, not just devices, but, you know, pushing forward new medical technology and interface with industry, which traditionally was thought to be sort of a, no, no, you know, those types of things didn't quite exist.

Respondent: So I never let my mind go there until I saw my friend and present his results of the meeting. And you know, even at medical meetings, I don't know if you've ever seen any of those very traditional people go up on stage. There's a few slides that you're going to speak to sort of robotic, and then this guy put up, like I never even seen an exploded CAD drawing before. Right. He was showing what he had made, you know, um, and the fact that he had made this brand new

invention tested in animals and he did that all in the span of one year fellowship, um, that he did with these other likeminded individuals. And I thought that that was insane in a great way. Uh, so, uh, that inspired me to go to this program, but I didn't have a good answer for myself as to how I was going to apply that to that to an eventual career.

Respondent: What I did have was faith that being in the bay area was a positive, um, that there was any stodgy university environment that would at least welcome this or be open minded to it. It would be a university in the bay or whether it's going to be Berkeley, UCLA or Stanford, you know. Uh, so, um, so it was a leap of faith. I went and started the startup with my friends. I'm not really knowing if I was ever going to do anything like this again once I went back to Madison, you know, honestly, if I trained for seven years to be a surgeon, well, you know, 11 years including medical school, I was not going to give up surgery, you know, that's my passion. That's my calling. But I also have this other thing. So I knew that I wasn't going to adjust exit medicine, becoming a medical device entrepreneur full time that wasn't being. But I also knew a few people that were role models that seem to be able to do some of that even within the confines of a medical career. So I looked at them as a bit of an inspiration saying everyone's answer slightly different. Everyone's a model with slightly different, but uh, and some were more successful than others. But, um, I thought that, you know, this may, this may be viable under the right conditions.

Interviewer: Yeah. So it was kind of an adventure as a huge... kind of, and correct me if I'm wrong, but if I hear... what I think I'm hearing is that kind of took the risk of that it might not advance your career, you might risk doing the opposite of that actually?

Respondent: Exactly. And in some ways I, I do have to admit it has or it had resulted in a bit of a step back from my career because it halted the momentum of that. It was, um, it delayed my ability to advance a by two and a half years maybe because the standard path would have been I graduated from residency. I do a one year fellowship and my specialty that I got a faculty job immediately from there and then they start on the clock, right. I, you know, I go into being a researcher or whatever. Um, I, I graduated in 2011 and my official job didn't begin here until 2014. So, you know. Yeah. Did that result in me losing out, if you will? It was a trade off. Yeah. Yeah. But in it's place, I have an incredible experience that I took part in. I have a company that like, despite the odds is still going is commercializing product, is healthy and doing well. I have these outstanding collaborators, close friends, people that I've networked with that or a different category of people that I interact with here and uh, and, and that informs my ability to be able to maybe succeed in future projects. Hopefully Lamprey or if not you something else.

Interviewer: Yeah. So, and so the reason that you continue doing startups, it seems like you would maybe do more in the future?

Respondent: I would love to, you know, I don't know exactly how my clinical career now, uh, take me. What often happens is that as surgeons just get busier with their clinical practice, just like, you know, I was late to um, uh, let's, um, how, how do I put this in a way that doesn't make me sound awful? Um, the, uh, the, uh, the mindshare becomes less the ability for me to be creative. I have to admit for myself becomes less because I'm focused on, I saw a patient number 10 today and I need to remember that person's, this, that, and the other. And there is only so much brain power that one can use in the day. And uh, that's the, that's I think the true source of the tension between entrepreneurship later on in one's development as a clinical surgeon. Uh, and uh, yeah. And, and the ability to actually do, do something you have to, to, to get something wonderful startup off the ground.

Interviewer: So, uh, yeah, that's the kind of your own inspiration with kind of the adventure and trying something new, learning new people. What, how do you see kind of the aspiration of the companies that do you want to build? Oh, like what would be a successful outcome for you?

Respondent: Hmm. Um, I think the only marker of success that matters is that it winds up actually becoming a, have a usable product for patients if it happens in the context of a startup company that we've formed that, you know, do the design and development and manufacturing in house and ultimately start selling it and slash or selling the company to another, you know, having been acquired by a strategic that can then market it more broadly. That's obviously wonderful. It takes a lot more resources to do that if it's in the context of, um, licensing the technology that really the IP is owned, is owned by UCSF since I'm a UCSF faculty. Um, if it takes that were the UCSF licensing folks will then licensed the technology to a company as is, and then they can do whatever they like with it, hopefully develop in a way that is compatible. That's also equally successful to me.

Respondent: I think as, uh, speaking from behind that ivory tower or within the ivory tower, there's, I'm not sure if other people share my opinion, but it's a little bit easier for me to give up on some of the goals of ownership, uh, because I would think that going through the, these types of fellowships, getting to know, um, so many amazing people that do really take huge amounts of risks. I'm starting up a company like people with engineering backgrounds that say that they, they're, they're quitting their stable job and they're just going to do this. Um, I have a much higher level of respect and humility about the process and um, what it means to take part in that process than I think a lot of maybe academics and slash or conditions that didn't have that experience. I think one of the things that tends to become a source of tension in academic innovation environments or places, settings where academics are inventing things and codeveloping with other people is that our sense generally as a, as a field or as a culture is to think, well, we came up with it.

Respondent: It's our patients. We know what's the problem and we were the true inspiration behind this technology. So why isn't most of low reward coming back to me,

right? Because I'm the inventor, right? Or, you know, even though there are other co-inventors on the application, I'm the real cheats and um, I would tend to disagree with that. I think that, um, the level of risk and energy and sold the one needs to put into a, a, a venture like this, whether it's a company or just design or whatever it is, a project, um, is profound and that should not be discounted. And if anything we're safe, we're safe than these like within the ivory, the ivory tower to say, well, I'm a surgeon, I can operate all day, you know, if I fail, I go back and do, do surgery. It's okay. Um, and there was a lot that I don't understand. Like let's make sure I know what the clinical problem is better than almost anyone for this project. Um, but Roman knows a hell of a lot more of exactly how this component ratchets to this than I ever will. Um, and it's foolhardy I think for either party to think that they are the, they are better or that they're more deserving of credit. And then then another. I'm not sure how we got here, but it was good. Yeah. Yeah. Uh, I didn't, I didn't mean to throw up.

Interviewer: Yeah, it actually is kind of speaking to it. There's like kind of the technical side and the shop section should have kind of the original or. Yeah, the main idea if you can say the kind of started at all with this section should wait, but also as you said, there's a lot of other tasks like this you'd hits to that and it was a Roman also talked about. So move the hip being specifically economically and there's like a lot of different things you have to consider. She said it's kind of a holistic and products. So, and I know you haven't been kind of on the sideline, but do like for you how, how do you prioritize these kind of older, these activities? Because I would imagine this must be almost more than you can even go there.

Respondent: Yeah, it's, it's, it's difficult to juggle. I think, uh, the way that I need to look at things generally. Just to go back to that whole thing is I need to be comfortable with other people taking the lead and the involvement with the project is as the project needs, whatever the needs of the project on her one needs to adapt to that. So I think if it weren't for me to project when that exist, that's true because no one would have put it in that initial effort to figure out whether or not it was worthwhile, whether or not the technology was compatible from a surgeon, factors, surgeon, human factors level, tissue level, you know, all that stuff. No one would have done that if I hadn't done it. But the project is now at another stage where we're now with advanced engineering. Yeah. I'm helping to guide sort of bigger picture things.

Respondent: But who's really driving that, you know, people like Roman, I won't, you know, we don't need to say specifically pull that. That's a huge goal. We need someone who can go and raise money. That's not going to be me. I mean, it could if I had decided to de prioritize a lot of other things, but I can't do that. Um, so, uh, I think if you multiply, multiply that by, by lots of different projects out there and think about, well, how, how best shall I provide value? And also how best shall I spent my time, both of which are discrete, limited quantities, right? Uh, I think that, um, depending on one skill set, you can push forward a little bit more to become more of an entrepreneur if that is your, is, is one's a talent or to be that guy that has their own little garage machine shop and can tinker and continue

to do stuff or be a very clinically oriented mentor that says, you know, um, we should run by every design through me so that we can definitely agree that this is the right way to go.

Respondent: Um, uh, you know, I think it all depends on one's talents and, and how they'd like to limit themselves. It's less, it's always a matter of limiting as opposed to exploding because I don't think that people can honestly serve a project well if they try to be everything every, all the time. Um, yeah. So for me personally, I think a clinically oriented mentor that has some reasonable expertise on big picture of how a startup should be evolving and progressing. I'm not as a CEO, I think that's foolhardy. And, uh, if I were an engineer, which I'm not, my, my undergrad training was in biochemistry, um, then I would want to do, be more intimately involved with machining and, you know, prototyping, but finding the right people who can compliment my skill set is important. And I think in that respect, I don't want that again, just say Roman, even though he's awesome, finding people like Roman has been great and you know, finding other folks along the way has been very valuable for the project. Getting to where we were

Interviewer: and speaking of that, finding them. So you've found for. But yeah, I also knew him second. He's a good example. So you kind of found him through the MTM program. So was that and little bit of luck that he ended up on your project or could you also reviewed the persons that was lead would be working on it? Oh, how did that end up?

Respondent: At that time, you know, Berkeley, the, the MTM program always like always tweaks of the process by which people get paired projects, mentors and the students. Um, for that year, Roman was, one was one of the only people that had a deep, deep mechanical engineering background and our project was one of the only ones that was presented to them where we really needed someone who can mechanical engineer prototypes. Um, there were a lot of projects that were quite frankly smarter than what I was doing, you know, like cerebral stuff, you know, a true bioengineering, you know, nanoparticle stuff, uh, material science, you know, things like that, um, or things that were closer actually to molecular biology, a gene, gene, gene expression assays, you know, things like that. So then I come along and I'm like, we're building a surgical tool. Anyone want to do this? And it was, it was luck, right? Because if it weren't for him being in that class, I wouldn't have had someone like him and he was truly unique that year.

Interviewer: Yeah. So, yeah. So in that sense it was, I mean, it wasn't involvement to be but still like would have been a bit of other. Yeah. And you would kind of also had to take the ones that wanted do a project. I would guess,

Respondent: yeah. Well, so here's the other thing that it's not as if there were no engineers, you know, we do have, we did have a surgical engine within the department of Surgery. We did have an engineer that was working on the project and he is in, was great, but he actually ran into some health issues and things so, so we needed to adjust to that. Um, and luckily the timing was right when Roman was

around too, and not only that, but it wasn't just rolling that join the project and it wasn't just rolling that contributed to the project to get it to where we were. He had other classmates, you know, we had a MTM team of four other people all with different skill sets who all we accelerated the land, pray to a great level. You know, we had one person focus a lot on regulatory strategy, so they wound up taking coursework in regulatory. I'm speaking with multiple consultant regulatory consultants and crafting of preliminary regulatory plan. We had another person who was more interested, more in kind of the commercialization side and also the um, uh, spin outside. So developing a, a rough operational and business plan. So I got to say those things are equally as important as designing an engineering, you know, I think obviously those are very important.

Interviewer: Yeah. And what, so yes, we had the MTM students. And what about some of the other people that have been involved? How have you kind of.

Respondent: Yeah, I'd agree with it but, but um, so we also, as I mentioned, we had the, we had one resident, a surgical resident, so she was a clinician but she was doing kind of a research years in surgical and the patient. So one of the projects that she was working on, what's the lamp, right? Um, and that was good in that she was learning a lot and she can help lead some of the clinical, if you will, the clinical human factors work because there were, at that stage we needed to do a lot of kind of brainstorming on how the handle was going to be in the interface between the surgeon and the um, uh, and the device. Um, so she was very good at that and her background allows her to be good at it. She did a part of her research here. She worked at Ideo and uh, she came from, um, a, a little bit more of a design engineering background to begin with.

Respondent: So that was good. She had since gone back to residency, so less involved at this point. Um, and then also again this engineer that was doing great and then the hill we had to mtm classes, so we had two years of MTM students. Both classes were different people. So, you know, if you add all that up, it's been like two and a half, three years. How's this project going with five people working on this full time on it? Well, uh, I would say at any given time it would have been like anywhere from three to five, three to five people.

Interviewer: Okay. Yeah. Yeah. So that's always working out, but also, yeah. So, but did these other people, would that something that you kind of lay out the project kind of at the empty in where you kind of lay out the project and then having the people kind of jump in? Oh, did you go out and saying like, okay, we need an engineer that also knew something about design and also knows something about human faces? So yeah, it's both actually. Yeah, like

Respondent: we have to pitch the project to the students who ultimately the students have to pick which ones they want to do. We can't force people to work for us or work with us. Um, so, you know, we certainly have to pitch that, but we are upfront and clear it during our pitch about what types of goals that we have for the project moving forward. Not necessarily we need you or you, but more like

where do we see this project going logically as to make progress. So our needs at the time, just to go back to Romans here, just as an example, or we needed someone who can, you know, rapidly prototype a head design for the instrument that many people would be able to identify with that and go for it. Go for it. In fact, if I were in the audience of students, I would have said, well, I can provide zero value that I don't know how to use solid works.

Respondent: I don't know, you know, well, what the heck do I do? Right. But Roman instantly grabbed onto that. The other things we needed were also things that were interesting to a good core group of people. Like part of the MTM program is to understand the regulatory environment for device design or whatever. So the fact that we needed to develop a rough regulatory plan was enticing to people. And then the third part I think, um, a lot of them had to do with, um, uh, what's the word? Oh, I'm testing the designs in, uh, in the context of a live animal study, which is exciting. You know, like if one can lead that and say that you did that during your mtm fellowship, that's a big win as opposed to, well, you were basically just entering my lab now and you're going to be my, like, modify Grad students or something.

Respondent: You know, I, I think um, uh, some of the projects has that vibe and nine was really much more flexible but a little bit more like we were truly being a startup where it's like, well, we have some resources, I have some grant funding. That's true, but we really want you guys to, you know, what I wanted to do was really recreate bio design with them was you guys are a team now. Like I want you guys to have a say in how the rest of the year is going to go with the progress of this project. And how did you.

Interviewer: No, because as you said, like your field is a little bit different. So how did you know what the next task word? Because if it's field that you're not so familiar with?

Respondent: Um, I don't know, you know, like I think um, some of it has to do with being volunteering myself to be a big picture person as opposed to being a, getting in the weeds, you know, like, um, the classic thing that happens is engineers want to engineer until the engineer and then they over engineer and then that's all they do and then we run into paralysis. Right? So was there a point when I was like, well, I feel like we're just sort of iterating too much, right? We needed to sort of decide on something and then move on. Like that doesn't take me knowing everything about everything, right? It takes a little bit more of just looking at the time span of what other things we need to accomplish and that design freeze or whatever that role in the rest of how everything else needs to progress.

Respondent: So, um, some of it was just nudging, it was more, Hey, hey guys, you know, you have to get this done before we do this. And then some of it just really was learning from the fellowship and knowing that generally these categories of things need to be satisfied on some level, not 100 percent, it doesn't need to come stamped with the medtronic brand and you know, look amazing. Um, but

every single cycle of the design and such just makes it a little better. Right. But you got to start somewhere and if you have four things for, you know, four out of five things that have been accomplished in a good, a cycle of device design, but one hasn't been done at all, then you haven't completed that. Right? So if you've done everything but decided, oh, hey, we've done zero on the Ip, we've not, we haven't invented anything. We haven't filed a patent application or anything that's a like that's a death knell, right? You might as well not have started because Ip protection is so important for medical device design. So, you know, it was all just a matter of trying to make sure that have all the pieces roughly fit together at any given time.

Respondent: And it's, that's why I credit the fellowship that I did to at least allow me to have a bigger picture of things to allow, you know, to say, look, we do need to get this done. I'm not the expert in figuring out how to get that done, but I'm just telling you guys we need to get this done and we'll figure it out somehow. I have zero idea like my, you know, my cofounder wound up being a CEO. He made me a design engineer for like a month and a half fully knowing that I didn't know what the hell I was doing. And he said, you know what? That's okay. Like we want you to really just get involved with this. And similarly, he welcomed when I said come to the aura with me and look completely out of place so that you understand why we're using our devices this way.

Respondent: And when I tell you that, you know, that's a hard no. When you say tonight, put this design feature on, you understand why it's a hard note. You know, like we all are, are idiot savant in our own way. Right? And it's really our role, if we're going to make these devices work for these ventures, go, are these projects succeed? A four, the skill sets to be complementary and for us to be humble about it, you know, and truly like I've seen a lot of projects fall apart based on ego, a lots of um, high, heavy talking, you know,

Interviewer: it just doesn't my death well in new. When you say make the product work, I just remember earlier you said that your aspiration was really bringing this product to the patients. Yeah. Yeah. So that would be, in this case for the [inaudible] case that would be having them have less internal, I don't want to say damage, but yeah, yeah,

Respondent: yeah. In a sense to have it be an actual, um, manifested with tangible product that a surgeon can use that has evidence that evidence or potential for less tissue injury when we're manipulating it for surgical purposes. That would be amazing.

Interviewer: Yeah. And that's kind of the whole inspiration. Yeah. Right. And then earlier when you said that also like for yourself, one of the goals of doing this was also to meet interesting people in. How would you kind of, how are they different from the few we would meet at this job for instance? I mean actually meet a lot of interesting people here too.

Respondent: Well, uh, I think, um, to try to perpetuate the stereotypes. There are certain stereotypes of different types of experts. The stereotype of surgeons aside from personality issues is that we generally tend to the, um, logical, pragmatic a, I won't say simplistic, um, but a goal directed thinkers and um, I think that, um, you know, many of us wind up meeting those characteristics of the stereotype, uh, many of the time, much of the time, um, some of the stereotypes for engineers is that they're incredibly analytical. Think of every possible permutation of outcome or a, you know, whatever topic might be, um, and uh, ultimately incredibly skilled at creation of things. Um, so where those two meet is what I'm talking about, right? Like the network of people that generally interact, speak. It doesn't matter if they're talking about their kids or they're talking about a work simply the way that people think and interact is different when it comes to a medical device.

Respondent: A engineer and entrepreneur that is, has, has gone through a path of working in a corporate environment. I'm gone to business school, knows how to sell, you know, low. That's also a totally different stereotype and personality that is good to, uh, understand. Um, so I think it's really valuable to learn those types of folks because they are, um, people like them make up a huge proportion, if not the majority of an entrepreneurial venture lead engineering community, right? Like Bay area being a prime example. Um, my community is very different. It's, um, people have grown up in a rigid system with mastery of content of a certain field.

Respondent: Again, logical practice, practical action oriented thinkers that have the ability to be creative but are in stuck in traditional potentially a traditional and rigid models. And so, uh, I'm sure this is the same for anyone, but there's a common saying like it's the most boring party for spouses is a party of like a work party of medical doctors because they wind up talking to about that. So the entire time and it's very hard not to. Um, so in that respect I think it's nice to put yourself outside the box and to be able to meet a venture capital guy who has training in electrical engineering who know how to ask questions that are different front end perspective from what we know. And same thing goes with any other things. Right. I don't know if that answered your question.

Interviewer: Yeah, no, that was perfect. A. Yeah. I'm just going back to losing a little bit. Also, you said earlier that sometimes you just need to make a decision because you can't just go around and around and around. So I would imagine that some of the reasons that you go around and around and around is at least some would maybe feel the thing we want to continue doing that is because maybe they feel like they have all they need to make a decision. So how do you then

Respondent: make that decision? No. Oh, maybe there's sort of sample of a recent decision that it's like, okay, maybe not straightforward, but we are doing this or um, I think that it's all a matter of perspective. You know, it is possible if one really wanted you to say that justification for step infinity, right? Like we don't have all the information, so there's no reference point for us to make the next decision. So we're just going to continue iterating until we hopefully find something in a

state of Nirvana that, right? Like, that it all depends on one's perspective, right? The, the other way of interpreting that is we'll never know everything that's impossible and we have to be comfortable taking a risk that we don't know and we're going to be wrong. Um, so how do we fail, you know, with the least repercussions? Because I'm only, if we allow ourselves to get to that moment, not necessarily only if we allow ourselves to fail, but only if we allow ourselves to think that failure is okay.

Respondent: I think we'll, we will get better. Right. I'm not as people per se, but like will the project actually move forward because, you know, iteration is, I'm on some level, a solitary activity, right? Not that, you know, two people can get together with three people can already together, but ultimately it's an inward facing process. Um, most of design I would imagine is an external facing process where most of the value comes from your feedback from what the real world tells you. And um, if we don't solicit that because we're afraid that we haven't gotten to the perfect state before, we're getting external validation. Um, then we'll never reach that point. Right. And then just requires multiple rounds of us saying, okay, well it looks like we've done a good amount of work here. Like regardless of what state it's in, you know, unless we're egregiously Lee bad.

Respondent: Whereas like, you know, we've done enough head design that right now it looks like it is going to a, it looks like a grenade is gonna explode or something, you know, outside of that we might as well test it and see what we got because it's almost guaranteed that we'll learn something that we didn't anticipate. Um, so I sort of feel like, you know, it's okay to take those, to take those risks and once you that perspective changes, then we can actually think about how we can fail the best, right? Because, um, you know, we often get into these conversations about, well, how much money can we lose at any given time? Like are we going to be viable or not if this, if this decision point, it turns out to be wrong. And um, if we're able to say, look, you know, we're gonna go ahead and invest this amount of money so that we can do this amount of testing, external validation, whatever.

Respondent: And just see the worst that can happen is that we spent that money and we learned something. Right, as opposed to, well we've iterated, we spend a lot of money already and now we're ready for let's say injection molding, which is going to be a lot of money. And then we ultimately realized that that design was flawed, you know, because we never really went back and found a way to try the test whether this was gonna be okay for molding, you know, like for example, I guess. Yeah, I mean I think the library has failed well multiple times. The, the device. Yeah, I guess we've, that is a good quote. I'm like, but we say that with a sense of pride because we did, we made this concept device and the goal of that device was to present it at a pitch and it went perfectly.

Respondent: The device itself didn't work at all, but at least people got the picture. Right. So that was a wonderful failure. We did the next round, the design where we, um, uh, ultimately we were able to test it in animals. Could the device actually go into the belly without breaking? No. Um, uh, did the, some of the heads wind up

like cracking in the, um, during the course of the experiment. Yes. But the animal study results were actually very promising. We failed magnificently, right? And then this round I'm Ronan is fine, you know, kind of getting together these designs that potentially can be put into molds and he's failing like crazy, which is beautiful because he keeps on telling me, you know, I can't spend this immense amount of money that you want me to spend because I'm not quite ready. And I think that's great because at least he's failing. Like he's, he's working and he's getting all this stuff done and he hasn't gotten to the point where he's paralyzed, where, you know, it's just like, well, I really think that like we need to switch this literally an eighth of a micron or something, you know. Um, he's, he's doing the correct things to

Respondent: fail well. And then ultimately even that is not going to be 100 percent right. We just need to take a sort of leap of faith and spent a good chunk of money on a mold. And if it fails, we will have learned something. You know, obviously we don't want to fail too much and lose money and never make proper, but we are making progress. So it's good. Yeah, that sounds okay. I just want to do it. How much, what? I've always been like a 45, so I don't know.

Interviewer: Oh, it might be almost an hour, but I actually got everything that a I need to know.